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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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Vol. 25. WORLD BUILDING, NEW YORK. No. 49.

Index to Advertisers and Classified Index Following Reading Matter.

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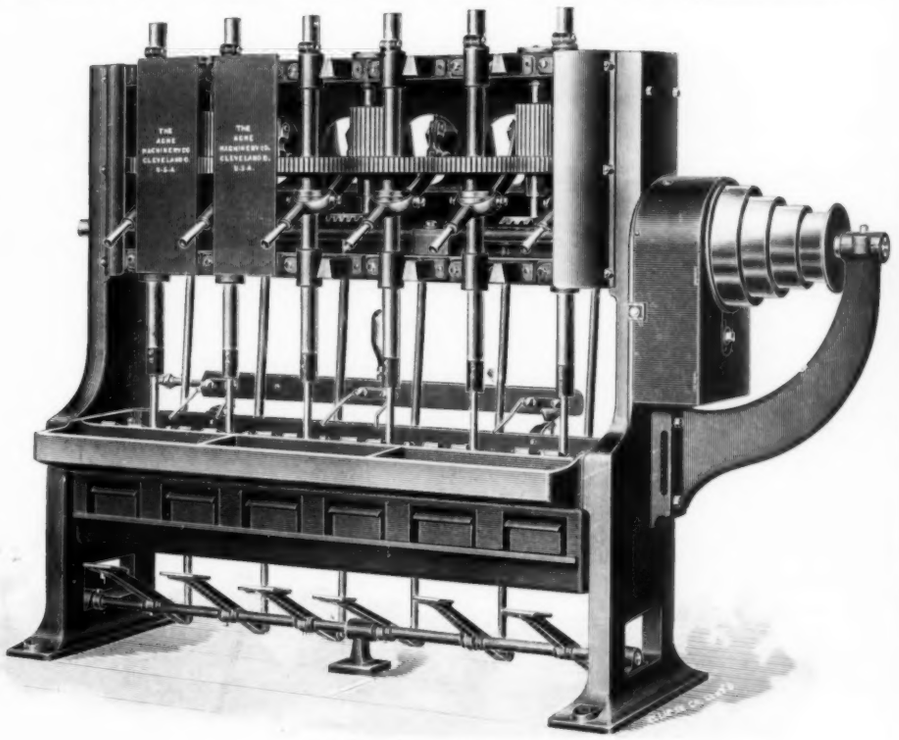

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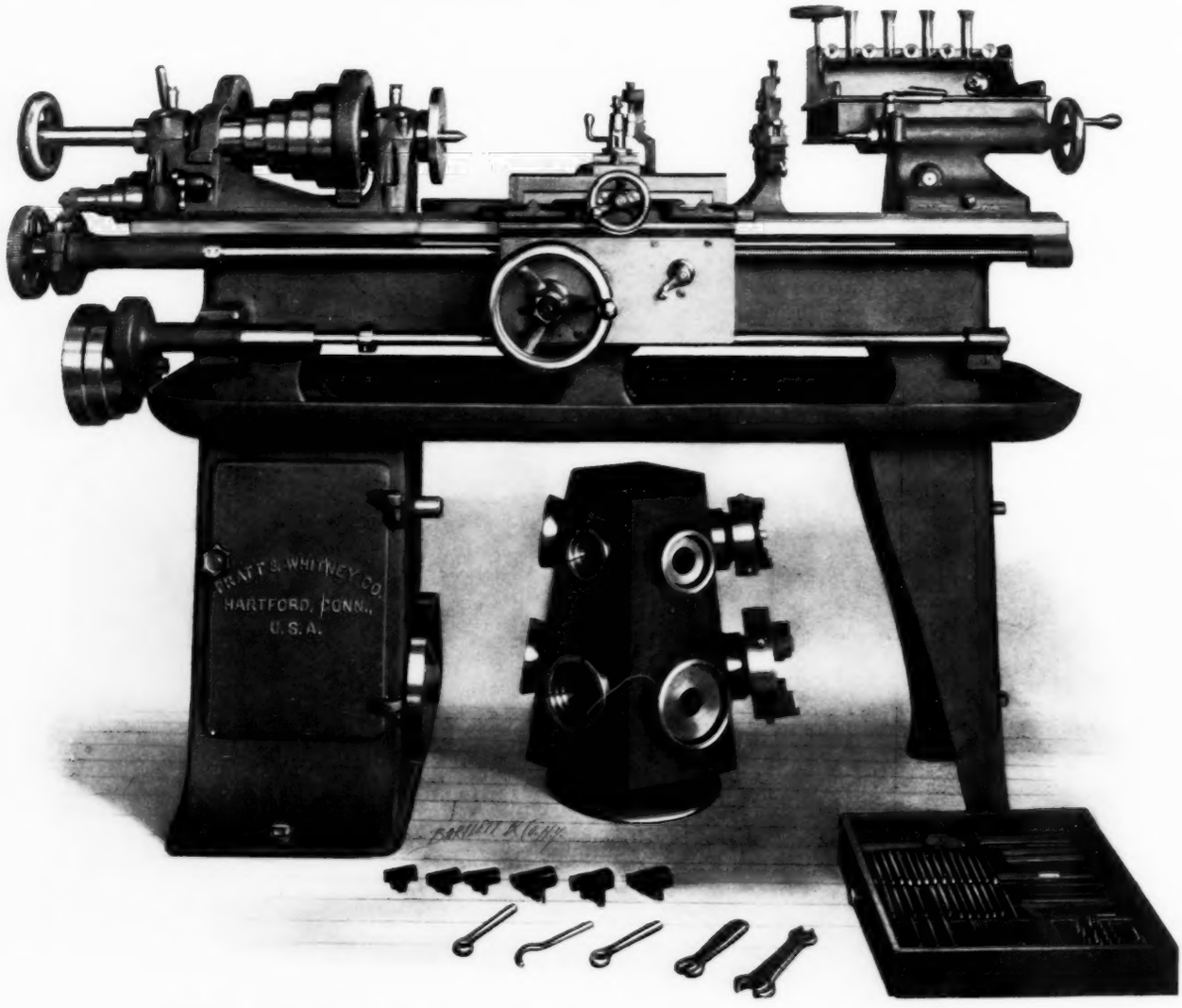

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Notes on English Shops.

Recently I had the opportunity of comparing notes on workshop and kindred topics with a number of friends during a journey which included Bath, Bristol, London, Luton, Coventry and Wolverhampton. A few notes taken *en route* may possibly be of interest.

At Bath I had the pleasure of again meeting a veteran engineer and contributor to technical journalism in the person of Mr. Joseph Horner, whose combination of experience of old-time workshop methods and productions, with intimate acquaintance with modern machinery and tendencies, is an outstanding instance of practical and successful personal culture, viewed from either the commercial or the recreative standpoint. Mr. Horner is in a position to gage pretty accurately the topics attracting most attention at the moment, and he inclines to the belief that the possibilities of commercially accurate milling and grinding processes are prominent among them. There is certainly much evidence in support of this view.

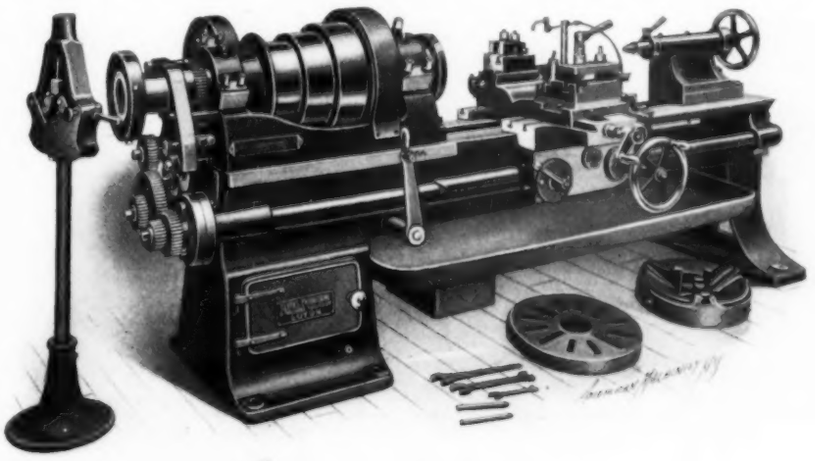
At Bristol, Messrs. Peckett appeared fully occupied turning out locomotives of types adapted to wide variations of duty. Great care has always been exercised by this firm in the matter of correct records of orders which have passed through their hands, and interchangeability of parts. As a case in point, an order came to hand the morning of my visit for a detail belonging to an order executed over thirty years ago, which would be supplied without entailing trouble or undue delay. Messrs. Peckett are consistent supporters of the best class of British toolmakers, and have evidently good grounds for their opinions, though I noticed a few really high-class American tools among the equipment. Pneumatic tools are extensively employed in the boiler shop in addition to a modern hydraulic riveting, etc., plant. Rather special attention has also been paid to the accurate production of substantial gun-metal fittings for locomotives, particularly of the more simple forms, which appear the most difficult to obtain in the ordinary way of the desired finish and interchangeableness.

At Messrs. Humpage, Jacques & Pederson, Ltd., a 20-inch drilling machine was being shipped to fill an Italian order, in which I was interested as having originally suggested their building this line, and utilizing therein the epicyclic gear designed by Mr. Humpage, and illustrated in one of your former issues. The original machine is now employed in a portable workshop, erected on a large outside contract by the company with which I am connected, its special virtue being good driving power combined with wide range of speed and handiness of manipulation. The latest type of this machine includes the speed-varying gear, reverse motion of the spindle for tapping, a table capable not only of rotating on its axis, but of swivveling to any angle between the horizontal and vertical—thus saving jigs and angle plates—and sliding towards or away from the drill pillar. This machine was illustrated in the English edition of this journal some time ago. In passing, it may be stated that the portable workshop previously mentioned contains a drilling machine, power screwing machine and grindstone, also a large power hacksaw by Mr. E. G. Herbert, Manchester, capable, in consequence of the arbor carrying the crank disk having its position varied eccentrically every twenty strokes, and thereby causing the saw blade to cut, comparatively speaking, on points instead of flats, of dealing quickly with girders, bulbs, channels and other constructional steel sections, and solid slabs. An oil engine works the shafting, and it is estimated that the saving in cost of carriage of material, and time due to the direct delivery on the job instead of in the first instance to the works, will justify the expenditure on the one contract. Later on, I may give some details as to time occupied, etc., in sawing various sections of steel on the Herbert hacksaw.

During a few hours' stay in London I noted several Canadian tools at the warehouse of Messrs. Burton, Griffiths & Co., Ltd., prominent among them being a couple of lathes by John Bertram, Dundas, Ontario. These tools appeared to combine in a marked degree American ease of manipulation with British solidity. The British type of compound rest and four-stud tool-holder were in evidence. A good line of bolt taps—the Butterfield—of Canadian origin, were also on view, and appeared to be produced on serviceable lines. On this topic, my experience is that American taps are generally time-savers when tapping cast iron or brass, but on tough mild steel the British taps score well, by virtue apparently of a tougher core combined with hardness of the cutting edges. At Ludwig Loewe's, in an interesting chat, Mr. Orcutt mentioned a distinct tendency on the part of British concerns to invite the opinion of qualified experts when contemplating extensions or reorganizations.

A large grinding machine for dealing with shafts up to 12x72 inches was being belted up, under the supervision of its designer, Mr. Norton, who expressed his intention of personally investigating the field open to this class of tool in the British Isles.

Returning northwards, at Luton, Clark's Engineering & Tool Company had about a dozen 14-inch swing capstan lathes in hand on a Japanese account. It looked rather curious to see the maker's or merchant's name in Japanese characters on the name-plates. The consignee insisted on these lathes being built to a specification and illustration issued by the company some years ago, and which had come into the customer's possession, notwithstanding that a number of improvements have since been embodied in the tool. A line in which, in consequence of personal experience of a 14-inch swing 3-inch bore hollow spindle lathe built by this company, I was much interested, took the form of an 18-inch swing, 4-inch bore, hollow spindle lathe illustrated herewith. Mr. A. Haworth, the works manager, whose early experiences as a member of a Yorkshire toolmaking family of deserved past and present repute stand him in good stead, explained that the bed of the lathe has been lengthened 12 inches, and cabinet legs adopted at both ends since the photograph was taken. I have since been furnished with a few particulars of the lathe, as follows: The spindle in the headstock is of hammered steel, the front journal being 5½ inches diameter and 6½ inches long, the rear journal 5¼ inches diameter and 5 inches long; a ball thrust is fitted to the front end of the spindle. The back gear ratio is 11 to 1; the cone pulley has three speeds for 4-inch belt, the largest diameter being 15 inches and the smallest 10 inches. The base of headstock is 30x16 inches. The bearings are of hard phosphor bronze, and, it will be noticed, are placed obliquely. No spanner is needed for the lockbolt when changing to or from double gear. The special turret tool rest and back slide cutting-off and forming



ENGLISH HEAVY HOLLOW SPINDLE LATHE.

rest, together with adjustable stops and graduated feed dials and the quick change feed gears, seem likely to give good results in both repetition and general work. Provision is made for a plentiful supply of lubricant to the work; the rack is steel, of comparatively fine pitch, the gearing being such as to give an easy hand feed to the saddle; and altogether the tool seems capable of good results, as regards cheap and satisfactory output. In conversation on general topics, Mr. Haworth ventured the opinion that any tool capable of standing up to the work demanded from it by Sheffield users is competent to take the field anywhere else. At Coventry, Alfred Herbert, Ltd., have built a well-arranged galleried showroom, in which it is intended to show a specimen of each tool handled by them. I was glad to see Mr. Oscar Harmer, recovered from a serious illness, about the works.

Several changes have taken place since my last visit here. Planing, as compared with slab milling, occupies a much more prominent position, and the considerable use of reeled black mild steel in place of bright drawn stock, in the automatic and other turret lathes, is noticeable. In fact, through the use of several particularly efficient special milling machines it appears possible to produce set-screws from round black bars more cheaply than from bright drawn square or hexagon stock. A battery of automatic lathes is engaged producing details for outside customers, and is a good vehicle for demonstrating the efficiency of the tools to prospective customers. In the toolroom I noticed quite a number of copies of the current number of the AMERICAN MACHINIST, newly placed on the men's benches, no doubt through the medium of a shop club, and showing a tendency to a desirable shop tone. Among several special types of their full automatic turret lathes was one arranged for chucking, boring and facing cast-iron skew bevel wheels as used on preparation machinery in cotton mills, the castings being fed from a hopper. This tool appeared markedly efficient, as indeed it must be to show any great reduction in cost of machining these castings as compared with the Lancashire method, greatly in vogue, of simple, low-cost tools and extremely expert "one operation" labor employed.

At Wolverhampton Exhibition Messrs. Herbert also show a representative line of tools in motion. Among the exhibits is an attractive vertical milling machine, one commendable feature in its details being the abolition of spanners as a medium for making adjustments, neat handles taking the place of ordinary nuts. Micrometer feed adjustments, wide range of feeds and neat, efficient guarding of gear wheels tend to confirm the favorable first impression. Messrs. Rhodes, of Wakefield, show a good line of presses, shears, etc., for sheet metal working, and their representative remarked that he could testify to the wholesome effect of American competition —chiefly as regards quick delivery—in accelerating improvements in shop equipment and methods. Messrs. Smith & Coventry exhibit a lathe bearing distinct evidence of American influence in its design. Quick changing of gears for screw cutting on Hendey-Norton lines is provided, though the English pitch of lead screw is retained. A flat turret lathe, the Robey-Smith double-tool bevel gear planer, small side planer, vertical boring and turning mill and radial drill give a good idea of the output of this concern, who also show a good selection of twist drills, reamers, milling cutters, etc., of their own manufacture. Messrs. B. & S. Massey, of Manchester, show examples of steam hammers of the type recently selected by the British Westinghouse Company for their smith shop, and also belt-driven pneumatic hammers, equal in effectiveness to steam hammers of the same nominal capacity. A good show in other departments of engineering is on view, but time did not permit of inspection, and I arrived home all the better for contact with concerns and individuals dealing with classes of work of a different character to my own.

JAMES VOSE.

Tool Holders.

The O. K. Tool Holder Company, Shelton, Conn., is making an interesting line of lathe and shaper tools, and in the accompanying half-tone several of their holders, together with various tools used in them, are illustrated.

FIG. 1. TOOL HOLDER WITH SET OF TOOLS.

Fig. 1 shows a very neat set of tools, consisting of a holder (which has been removed from the case in order that it may be more clearly seen), an assortment of diamond points, side tools and square noses, outside and inside threading tools, a cut-off, radius tool, spotting tool, boring tool and knurl, the body of the latter being jointed so that the knurls will center themselves. The cutting tools are drop forged from a high grade of tool steel and accurately ground for clearance. Each tool is formed with a round shank, and is faced off at the bottom and ground at the back, square with this shank, so that when in place in the holder it will be firmly and properly backed up. The holder is drilled through lengthwise for a rod which has at its front end a head bored out to receive the shank of the tool. The rod is threaded at the back end and provided with a handle by means of which it is tightened and the tool drawn back, as shown, and held rigid against the front of the holder.

For carrying the spotting, the boring or the inside threading tool, a special head (shown at the back of the knurl) is provided. This is bored out to receive the tools and formed with a shank which fits the head of the draw-back or clamping rod. When tightened against the front of the holder, a small shoe, with which the head is provided, is forced into a shallow groove in the tool, and not only keeps the latter from slipping endwise, but, acting as a key, also prevents its turning under the cut.

This holder is especially useful where tools have to be changed frequently, for

a tool can be removed and another inserted without disturbing the adjustment of the holder in the post of the lathe or shaper, and the change can be very quickly made, as a quarter turn of the handle is sufficient for tightening or releasing the clamping bolt.

When so ordered, the cutting tools are made of one of the special steels for high speed, and, in such cases, to prevent mixing up with other tools, the name of the steel is stamped on the finished surface at the back of each tool.

The holders are made in three sizes—⅜x¾ inch, ½x1 inch and ⅝x1¼ inches.

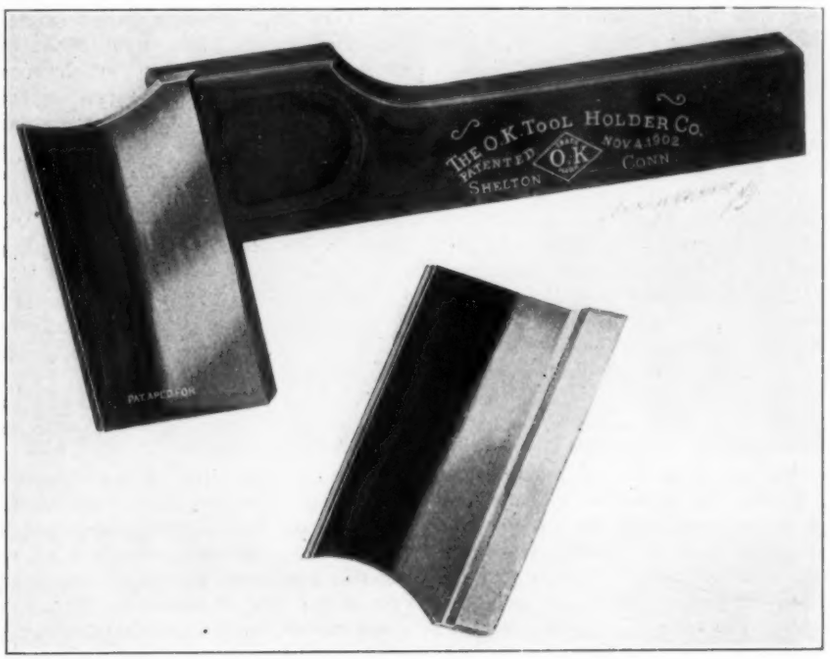


FIG. 2. CUTTING-OFF TOOL.

Fig. 2 illustrates a cutting-off tool which requires little description, the halftone showing it pretty clearly. The blade, it will be noticed, is formed with a tongue at the back which is beveled at one edge and fits a corresponding groove milled in the head of holder. The clamping plate, let into the side of the head, is beveled at the front edge to suit the blade, and, being provided with a threaded shank, is drawn tight into place to hold the blade, by means of a nut at the back side of the holder.

The tool is cleared at the top, and has a central cutting point which divides the chip and thus makes a clean cut. If undue strain is put on the blade when cutting, the clamping device allows it to slip down and prevents its breaking. Both straight and off-set blades are furnished with the holder.

In Fig. 3 is shown a holder—similar in design to that in Fig. 1—which is fitted with a small turret. The turret proper turns in a vertical spindle and rests on a plate which has a shank fitting the hole in the head of the regular clamping rod. The turret has a locking pin and a clamp nut, and is arranged to receive four tools, those shown being used for spotting, centering, center reaming and truing the end of a piece of work held in a lathe chuck or back-rested. The head of the locking pin is conveniently located and the turret can be quickly operated.

All parts of the tool-holders illustrated are finished all over and hardened.

Echoes from the Oil Country.

AN IDEA—WHAT IS IT WORTH?

Turning the pins on the crossheads of Oil Country steam engines was always a hard job that wasn't much sought after. As these crossheads are cast in one piece with the pin as part of them, it will be seen that ordinary methods were out of the question. In most shops the turning is a case of "armstrong," as the boys express it, that is, mounting the crosshead on the lathe centers and pulling it back and forth through at least one-half a circle each time, while the feeding is done by hand or by letting the lathe run slowly. It is perhaps needless to say that it did not take many crossheads to keep a lathe hand going all day. From the nature of the motion and the feed the finish was not always first class and the filing and polishing had to be done with the work standing still.

When a man came walking in and said he had an attachment that could be put on any ordinary lathe and would turn up crosshead pins in just about twice the time it would take to turn an ordinary round piece of iron of the same size and length, he was well received and told to show what it would do.

I do not know how good his device may have been, as I did not get a chance to examine it, but I do know he worked for several hours without getting it to operate on that lathe and finally gathered up his things and left.

This called the attention of the men in the shop to the job, and several of them tried thinking up some device that would work.

One man thought up a plan that he thought might work, but after viewing it from various sides and discussing it thoroughly with a fellow-workman he saw it would not fill the bill.

The second man, taking the ideas of the first man as a starting point and seeing why they would not work, planned things somewhat differently and had a design that would work. This design was entirely different in principle from the first man's, although it used some of the same parts and at first sight had a somewhat similar appearance.

After sketching the idea out and doing some measuring, it was foun I that it could be put on one of the lathes, and he was told to proceed to build it and try it after he had explained to the superintendent just how he intended it should work.

Circumstances that arose prevented him from putting the ideas into working shape, and the superintendent explained the idea to a man engaged on tool work. This man followed his i 'eas and produced a design that was much more concentrated and self-

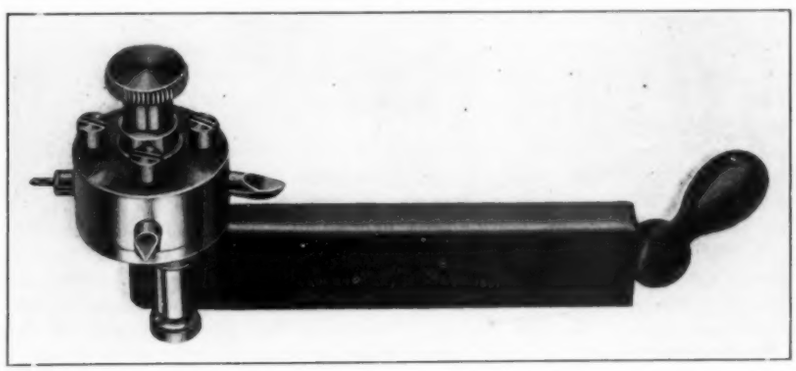


FIG. 3. TOOL HOLDER FITTED WITH TURRET.

contained than the second man's and in every way better, but did not have anything new, so far as ideas, mechanical movements or operation went. This design, while the mechanical equivalent of the other design, being really the other design

squeezed together and made compact, did not look like it nearly as much as the second design had resembled the first design.

In thinking over this I have often wondered who deserved the most credit in the matter. If the first man had not started to planning and by his sketches interested the second man, the second man would not have done what he did. If he had finished the machine, it would not have been nearly as good as the one that was made. The man that worked up the design got his outline from the second man's ideas.

The machine proved more expensive to build than was anticipated, and before it was done the company began to think they had made a mistake in making it, but when it was done it proved a good thing and saved time and hard work.

Supposing this company paid for ideas, who should have the pay for this one, and how much would such an idea be worth?

Another thought comes to me. I think only one of these has ever been made. Supposing someone took hold of the idea and by advertising and pushing the business made money out of the thing, who would deserve the most credit, the inventor, the designer or the promoter?

While my experience in such matters has not been very extensive, I have usually found that the promoter generally cannot see why he should share very largely with the others, as they were not making any extended use of the thing.

The designer feels that the promoter would not have anything to push without him, while the inventor feels that there would not have been either a design or a business without his invention. The one that started the thought thinks he might have perfected the ideas he had if the others hadn't. So they all feel as though each were the important link in the chain.

Perhaps most men who have been long in the trade have been approached by someone with ideas of an invention that was entirely without merit in itself, but that awakened a line of thought that led to good results. What credit does the first man deserve for the work of the second?

While legally a man may have no right to expect pay, yet I gather from some of our friends that some shops undertake to pay directly for ideas that are useful, without regard to whether they would legally have to pay or not, the idea of course being to have the benefit of mental alertness in their employees.

The idea seems reasonable enough, yet I cannot help wondering how it works if all sides could be known; whether the man who gets something for an idea that may be developed into a really important thing afterward feels as if he received all that he should; whether the man who has his idea turned down never thinks someone has taken advantage of him when he sees what may seem to him the same idea in use; whether in reality the system, considering the class and number of men employed, has important advantages that more than offset all the disadvantages.

I would like to call attention to two things: One is that the fine shops, with good buildings, good tools and good (or supposedly good) systems, are not always the popular shops among the men, nor the ones where they get paid the best. The other is that many shops that are not given any credit for it do pay, and pay well, for ideas, and that without any special system.

One man used to always be able to get the highest wages the shop paid. He was not a record maker in any line, but he had two *very* valuable qualities. He would go at any job he was given with cheerful willingness, and he would find *some* sort of a way to do any possible job. It took a long time and many trials to convince him that a job was impossible. Someone or other in the shop could generally do any job he did at least as well, yet did not receive as good pay; so the extra he received was for ideas.

Take two boys starting to learn the trade: One plods along picking up skill by laborious effort and constant repetition. The amount he can acquire is limited by time and also by his opportunities. The other one studies principles and is mentally alert and gets skill much more rapidly, besides being able to apply that skill in more numerous places. Besides having a knowledge of *why* things are done, he does not have to go through a long course of "breaking in" at the hands of the foreman on every new job as the first one does.

If you wish to know the value of the ideas in these cases, keep track of the wages each receives for a term of years, and see what sorts of jobs each has, say, ten years after they are out of their time; or look around your own shop and see what makes the difference between the men you look up to and those you look down on mechanically; also see which class has to work the hardest and which class is most wanted and also most apt to advance. I think the differences will be due to the value of ideas.

It is often asked, "What is a trade worth to a boy?" Often parents and others interested in boys wonder if it really pays to have a boy spend three or four years of his life working for very small wages to be ranked as a machinist at the end of that time.

D. E. M., at page 1405, gives very clear light on one side of the question in "Which Is the Best Trade for My Boy?" which is worth careful attention. However, there is a class, and a very large one, that never shows any decided tendency in any direction; the question with these should be: "How can I get the most out of the trade I am at?"

To these I believe the best answer is: get ideas. I don't mean facts simply, or knowledge memorized from a book, but the real, live, active ideas that are putting the facts and this knowledge to use.

A fact is a tool. When you know the fact it is your tool. When you have a live idea that makes use of the fact in your work you have the skill to use the tool. You cannot use a tool you do not have, but how much better is it to have it and not make use of it?

When I see a young man working for years to acquire the skill necessary to his trade and neglecting the ideas end of it, I think he is either poorly informed as to their value or else mentally lazy. Surely otherwise he would spend a few dollars to get access to the literature that is supposed to contain ideas, for he is willing to give up many dollars to be allowed in a place where skill can be obtained.

I do not for a moment mean to insinuate that there is any place more prolific of ideas than a machine shop, but the men who have the most in any shop are the men who keep posted about what is going on in the other shops. If nothing more can be understood from reading a paper than that there are numerous ways of doing things and endless points of view for looking at them, the cost is more than repaid.

There is one thing I would warn against. If you get into the habit of getting all you can of other men's ideas into your head, you will find they will breed ideas of your own, and if you are afraid of ideas of your own, you should be careful how you expose yourself to contagion.

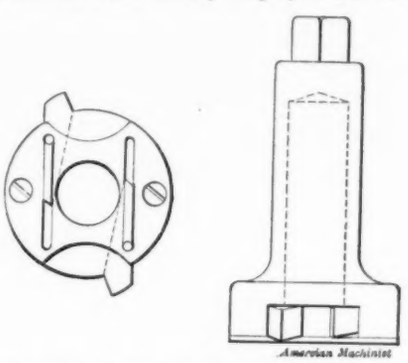
If a good lively lot of ideas got possession of you once, you don't know where it might end. You might have your wages raised or be a foreman. It might get so bad that you would be superintendent or even have a shop of your own. Then you would have to try to grow ideas as a regular part of your work. Wouldn't that be awful?

That fellow that is always "kicking" about other fellows' ideas but that never grows one of his own is an "immune." Of course he doesn't work in our shop, as most of our fellows have been inoculated with virus from the AMERICAN MACHINIST, and we don't like to expose those free from it.

W. OSBORNE.

Tool for Setting or Extracting Studs.

The cut—adapted from *The Mechanical World*, London—shows a handy tool for inserting or removing studs. It differs from the tools usually employed for this



TOOL FOR INSERTING OR REMOVING STUDS.

purpose in that it takes hold of the unthreaded portion of the stud, a specially valuable feature when removing broken studs or those whose threads are seriously mutilated. The tool is dropped over the stud and the toothed wedges are pushed in to equal contact with the stud on each side and on turning the tool these wedges grip the stud tightly and turn it as required. To reverse the action of the tool, the plate is taken off and the wedges are slipped in the other way.

The Springfield (Mass.) Evening School of Trades.

BY E. R. MARKHAM.

The Evening School of Trades is supported entirely by the city of Springfield. It is often spoken of as The School for Trades because it is intended primarily to help men working at the trades. It gives the mechanic who wishes to perfect himself in things pertaining to his trade a chance to do so, or it gives him a chance to familiarize himself with things that perhaps he had no opportunity to learn when young. For instance, many good mechanics entered the class in mathematics last term, thereby getting instruction from a competent teacher in just those branches that would be of benefit to them. Many mechanics who were not well posted in reading working drawings have taken advantage of an opportunity to receive practical instruction in mechanical drawing from an instructor who was for many years head of a drafting room in a large factory.

In this age when electricity is so prominent, it is not surprising that a very large class was formed for instruction in this branch. The instruction given was thoroughly practical. The class was under the personal supervision of the principal of the school, Mr. Charles F. Warner, who also has general supervision of all the courses.

I am often asked what machines we build in our school. We do not attempt the building of machinery only as project work. That is, if a pupil is willing to devote additional time over and above that allotted, we allow him to work on machine construction, but our time is very limited and the building of any machine that could possibly be constructed in the limited time would not involve the principles the pupil should get. Our output is our *pupils*, and not a manufactured article. Consequently we should not feel ourselves justified in keeping them on work that simply perfected them in one or two exercises. As our pupils get their practice in the shops where they are employed, we devote our time to teaching them the proper methods of using machines and tools and the best and most practical ways of doing work. We do not teach trades, but the principles of the trades at which our pupils work in order that they may be better workmen.

FIG. 1. EXTERIOR OF THE SPRINGFIELD EVENING SCHOOL OF TRADES.

The evening classes are due to Dr. Thomas Balliet, who, when the Mechanic Arts High School was established, suggested that the excellent equipment of the school might well be used for this purpose. Acting on his suggestion, the school board authorized the opening of classes in two departments, and, from time to time, other departments have been opened, until now a young man can obtain instruction in the following courses: Electricity, mathematics, drawing, woodworking and pattern-making, plumbing, and machine-shop practice and toolmaking. The instruction in all of these courses is free, except for a fee of $5 in the shop courses for materials.

Fig. 1 shows an exterior view of the building and Fig. 2 an interior view of one end of the machine shop.

The course in mathematics for mechanics is conducted by Mr. Arthur Dean. It includes the subjects of arithmetic, algebra, geometry and trigonometry. Only such phases of these subjects are taught as have a direct application to the mechanical trades.

The course in drafting covers three years, and consists of two lessons a week. The course is designed to teach mechanics or others the principles and practice of mechanical drawing in order that they may be able to read and make the ordinary drawings used in the mechanical trades. This course is under the supervision of Mr. Frank E. Mathewson.

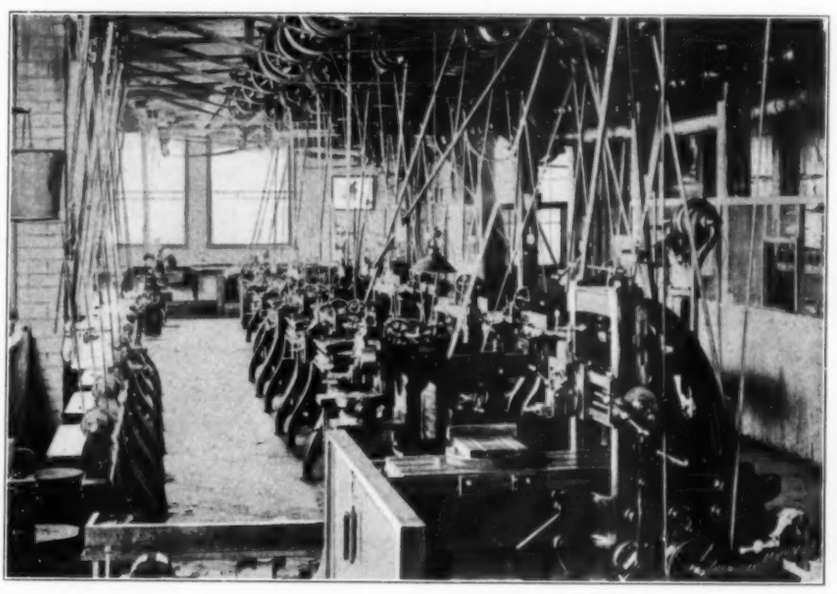


FIG. 2. INTERIOR OF SPRINGFIELD EVENING SCHOOL OF TRADES.

The class in plumbing has three lessons a week. Most of the students are employed in different plumbing establishments. The course aims to give instruction in the theory and practice of plumbing. The instructor in this department gives one lecture each week on various sanitary questions connected with the

trade. This class is conducted by Mr. Tower.

The class in woodworking has two lessons each week. Most of the members of this class desire patternmaking. Mr. Edwin Finch, formerly of the Teachers' College, New York, has supervision of this department.

There are three classes in machine-shop practice and toolmaking under the supervision of the writer, assisted by Mr. Charles Wilcox, a toolmaker in the United States Armory, of this city. The object of these classes is to offer to properly qualified young men an opportunity to obtain training in machine-shop practice and toolmaking. The course of instruction is so planned as to give a working knowledge of the various machines, measuring instruments and methods used by skilled workmen.

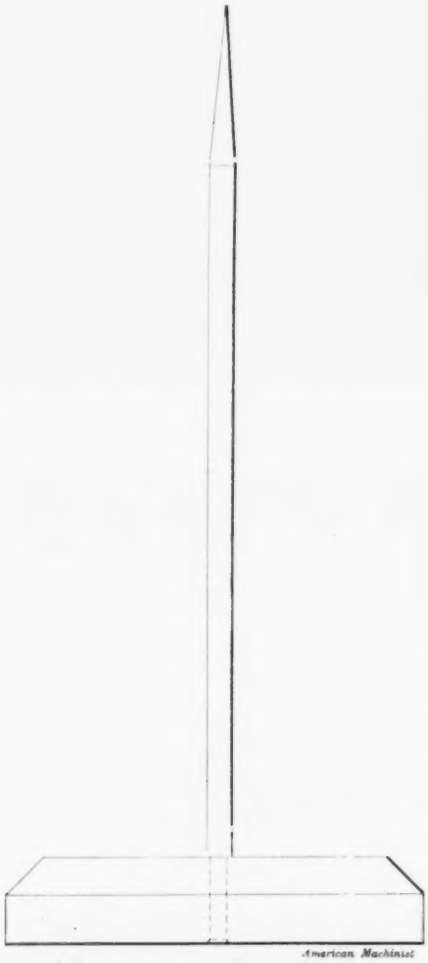


FIG. 3. LETTER FILE EXERCISE.

The equipment of the machine shop embraces the following machines: Fifteen engine lathes, sixteen speed lathes, one Brown & Sharpe universal milling machine complete with all attachments, one Van Norman milling machine, two universal grinding machines, one sensitive drill press, one upright drill, one planer, two shapers, one water tool grinder, one twist drill grinder, and a large assortment of tools, including cutting tools and measuring instruments.

As stated, there are three classes: the beginners' class, the intermediate class and the class in advanced toolmaking.

The members of the beginners' class are given as thorough instruction in the use of the file and cold chisel as seems advisable. When they become fairly proficient in the use of these tools, they are given a square block of cast iron from which they must, by means of chisel, hammer and file, produce the base of the letter file shown in Fig. 3. It is insisted upon that the surfaces be flat and true, the edges straight and square, the angles of the beveled edges 45 degrees, and the top and bottom parallel. The spindle is made of drill rod, the point and end that fit in the base being turned in the speed lathe by means of the graver.

They are then given either a clamp dog or a pair of parallel jaw clamps to make. The stock is cut to length and filed to shape, the holes are drilled and tapped, and the screws are made on the speed lathe, being turned to size by means of the slide rest and the threads being cut with a die. In the case of a clamp dog, the tail is turned by means of hand tools. As the next exercise, a rough forging of a hammer head is given. It is filed to shape and the eye is drilled and filed to size, as shown in Fig. 4, which shows some of the elementary exercises. In all these exercises much attention is given to filing surfaces straight and square with each other.

The student is now given a drawing of a handle, also shown in Fig. 4. He files a templet to the outline shown by the drawing when on the speed lathe and by hand tools he completes the exercise, shaping the handle to the templet.

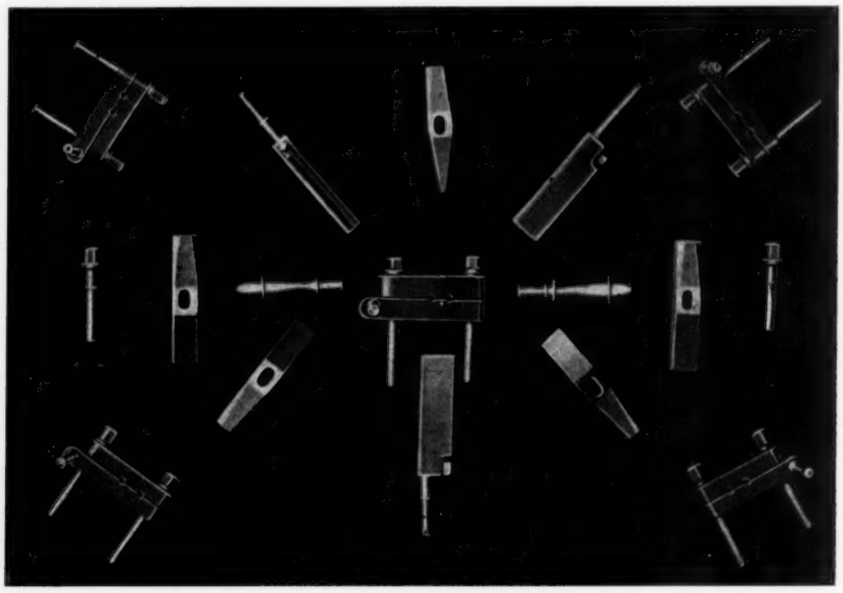


FIG. 4. EXERCISES FOR THE BEGINNER'S CLASS.

Now that he is somewhat familiar with the tools, he is given a drawing of a piece with dimensions in decimal equivalents, which he is supposed to get by means of spring calipers and with it he is given a piece of stock. At that point he is given personal instruction in the use of the micrometer; a general talk is also given to the members of the class on the construction and use of the tool.

The next exercises are in turning on the speed lathe by means of the slide rest. These exercises include straight and taper turning, and straight and taper boring or inside turning.

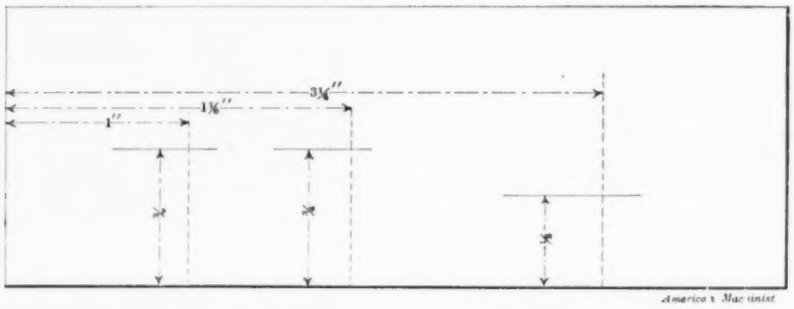


FIG. 5. AN EXERCISE IN LAYING OFF AND BORING.

The students are then given a piece of flat stock and told to lay off two or more points at given distances from one end and side, as shown in Fig. 5, after which the piece is clamped to the face-plate of

a lathe, the located points are trued up by means of a center indicator and the holes are drilled and bored to size. All this is done on the speed lathe, because of the limited number of engine lathes at our disposal, and it is my experience that the principles involved can be taught as well in this manner as in any other. An experience of twenty-three years in machine shops and sixteen in charge of work has taught the writer that far too little attention is paid to such training as involves the use of the file and hand-turning tools. We have many young men in our school who are serving an apprenticeship in some one of the numerous shops in our city or in some adjoining city, and they appreciate very much the training which they realize they should have but which they fail to get in the average shop of today. We also find that the refining influence of our insisting on accuracy when he is taking the elementary course is very beneficial to him as he advances, and,

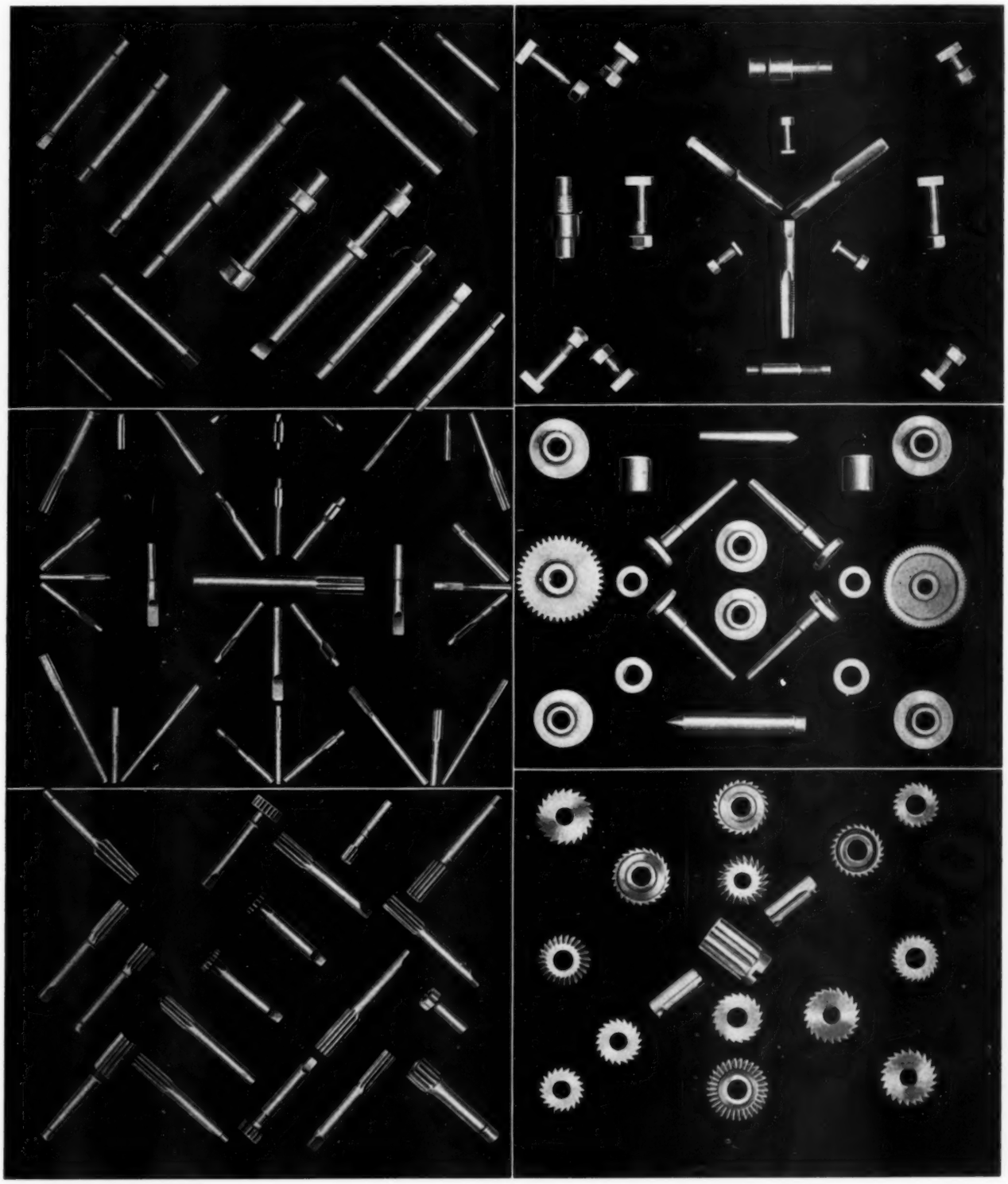


FIG. 6.
FIG. 7.
FIG. 8.
FIG. 9.
FIG. 10.
FIG. 11.

EXERCISES FOR THE INTERMEDIATE CLASS.

moreover, it tends to make itself felt in the shop where he is employed. For this reason employers in many shops endeavor to influence their young men to attend the school.

The intermediate class is composed of men who have received the instruction described in the beginners' course.

The first exercises are given with the idea of making them familiar with the use of the engine lathe and the simpler forms of tools, or I should say the more commonly used tools, such as the side tool and the diamond point. As a rule, the first exercise given them to make is a mandrel, shown in Fig. 6, the more complicated exercise of making the taper arbor, gang arbor and milling machine arbor coming later in the course. The mandrel gives the student a knowledge of the necessary amount of allowance to make when turning a piece of work that must be hardened and ground to finish sizes. He is also taught the necessity of centering his work properly, and instruction is given

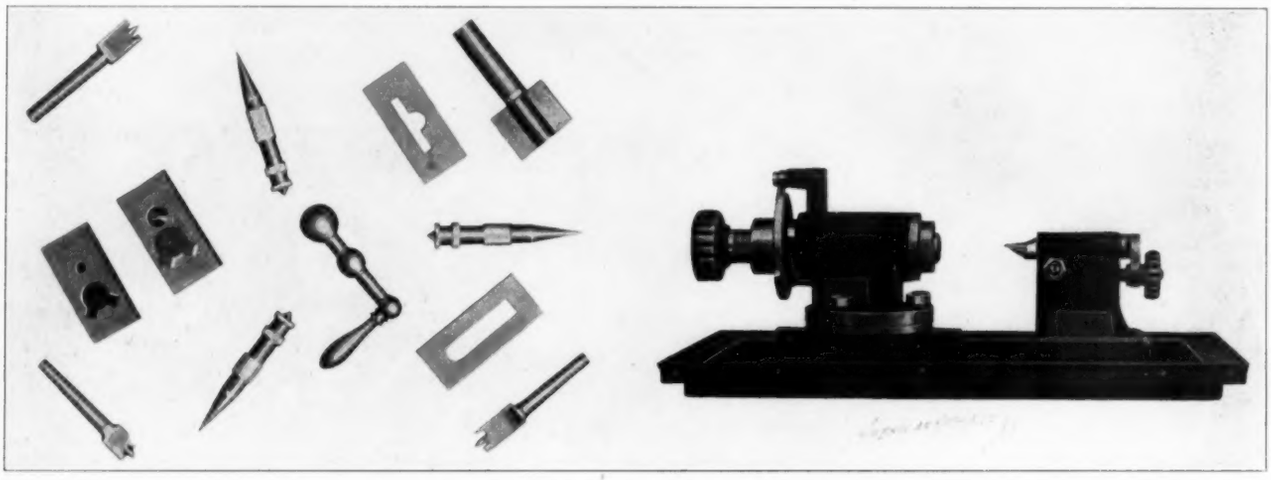


FIG. 12. EXERCISES FOR THE ADVANCED CLASS. FIG. 13.

him regarding the proper way of hardening the various pieces of work he makes. After the mandrel is hardened he laps the centers to the proper angle and truth and grinds the piece to size. The necessary amount of taper it is advisable to give a mandrel for various purposes is explained to him, and he is given the necessary advice in regard to not heating the piece more than possible when grinding, on account of the liability of its springing, and the danger of calipering a piece for size when it is warm is explained.

After finishing the mandrel the student makes a reamer and a counterbore, shown in Fig. 7, and occasionally the single-lip reamer shown. The counterbore, in addition to the practice involved in making the mandrel, gives the student the use of the milling machine and a knowledge of the index head, the construction and use of which are explained to the class.

Following these exercises, stock and drawings of two or three of the forms of shank mills, shown in Fig. 8, are given out. In addition to the work which has become familiar in the preceding exercises, these bring in taper turning, taper grinding and grinding the teeth with the necessary amount of clearance for cutting.

Contrary to the method usually followed, screw thread cutting is not brought in until the student is thoroughly familiar with the lathe. Thread cutting is introduced at this point, the exercises being the bolts shown in Fig. 9. When familiar with this work, a nut arbor, a tap or a set of taps is given out, all of which are shown in Fig. 9, those shown having been made by a member of our intermediate class last winter. This student roughed out the stock, annealed it, turned the taps to size, threaded them with a chaser, which he had previously made by a tap in stock, milled the flutes and backed off the teeth for clearance in a manner that was highly satisfactory to his instructors. He also hardened and tempered the taps in an excellent manner.

The next exercise is in chucking pieces of work. The collars shown in Fig. 10 are chucked, bored and reamed and the face-plates have the holes bored and threaded to fit a gage. In making the gears the blank is properly machined, the significance of the pitch line is explained, as well as the amount necessary to add to the pitch diameter in order to get the outside diameter of the blank, and the teeth are then cut. The exercises of taper turning shown on this plate are more elementary and are made earlier in the course as special exercises.

Fig. 11 represents exercises in making milling machine cutters and shell reamers, which, in addition to the practice obtained in the preceding ones, involve internal grinding and lapping, grinding the sides of the mills or the bosses surrounding the holes, grinding the teeth of bevel cutters, etc.

The exercises given the advanced class depend in a measure on the previous experience of the individual, as this class is composed of students with varying amounts of mechanical knowledge and experience. The class of last winter contained several machinists who were anxious to learn something of toolmaking, several toolmakers desirous of learning some branch of the business they had no knowledge of, as well as a number of men who had served an apprenticeship and were working as journeymen machinists, but who had never had any experience in running a universal milling machine and wanted special instruction in this.

The exercises shown in Fig. 12, with the exception of the ball handle and spur centers, are specimens of work done by this class. The handle and centers were made by members of the intermediate class. The plumb-bobs shown were made in order to give some members of the class a knowledge of the proper method to follow in turning the outside of a piece perfectly true with a hole running only part way through it. It answered the purpose and made a very interesting exercise. The milling machine centers represented in Fig. 13 were also made by members of this class, and are in use on one of the milling machines in the shop.

This school is not a trade school, and we do not teach any trade. We could not, as our time is too limited. Our school is in session twenty-one weeks during the fall, winter and spring months. Each member attends two evenings a week. The school is in session five evenings, but the enrollment is so large that the instruction is so arranged that each member attends forty-two evenings during the term, from 7.15 to 10.15 o'clock. Even this limited time, however, gives a machinist a chance to get instruction in such branches of the trade as he is deficient in, and the methods followed in most shops having an apprenticeship system are such that a great many who have served "their time" have but an imperfect knowledge of the trade they are working at. To such men this school furnishes a means whereby they may gain the knowledge they lack. It also appeals to the young man serving an apprenticeship

in a shop where he has no opportunity of learning certain essential principles he should know. We devote all our time to giving instruction on those points in which our students are deficient.

From time to time during the term lectures are given the students on various subjects pertaining to modern machine-shop practices and methods. During the term of 1901-1902 four lectures were given on hardening and tempering steel, which were well attended by the members of the school and also by toolmakers and blacksmiths employed in the various shops in the city.

A New Test Indicator.

We illustrate herewith a test indicator recently brought out by H. A. Lowe, of 158 Lowell street, Waltham, Mass.

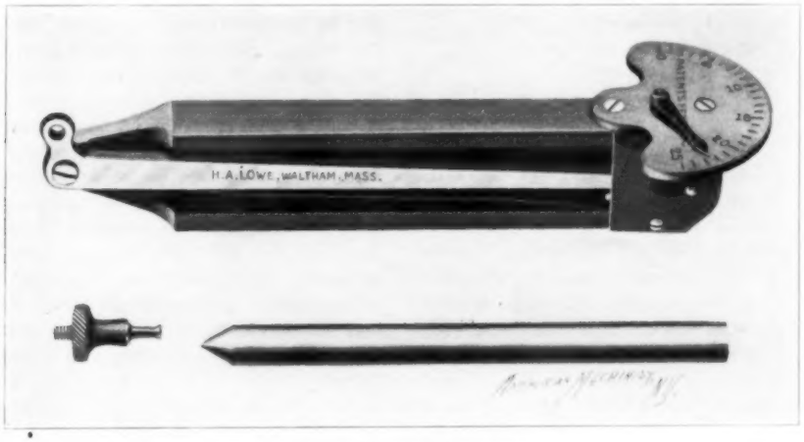


FIG. 1. NEW TEST INDICATOR.

In this tool the graduated plate, which reads to thousandths of an inch, is placed at the back end and on top of the holder where it may be easily read. The pointer is carried on a spindle having a body provided with a spiral groove in which fits loosely the end of the indicator arm. A flat spring is placed, as shown, under the arm to lift it up and throw the head or contact point forward, and a light helical spring holds the spindle or cam back and keeps the edge of its groove against the end of the arm. The head at the front of the arm being held in contact with the piece to be tested, the back end of the arm rises and falls, if the work is not true, the cam is rotated, and the error is shown by the swinging pointer. Any movement of the short arm of the indicator is multiplied through the long arm and cam nearly one hundred times; thus a very slight error in the piece being tested may be readily detected.

This indicator may be used on a great variety of work. For internal work the attachment shown in front in Fig. 1 is provided. This fits the hole drilled in the end of the arm and has a threaded shank and knurled nut by means of which it is held in place. Fig. 2 shows the indicator with this attachment as used in testing the truth of the center hole in a lathe spindle. The small pointed rod furnished with the tool is used when locating a jig or similar work on the face-plate, as shown in Fig. 3.

The tool is very sensitive and may be made still more so, or it can be stiffened, by changing the end of the spring on the pointer spindle—which is held in a small hole drilled in the graduated plate—into a different hole, there being four holes drilled for this purpose. All working parts of the indicator are hardened, the shank and dial being case hardened.

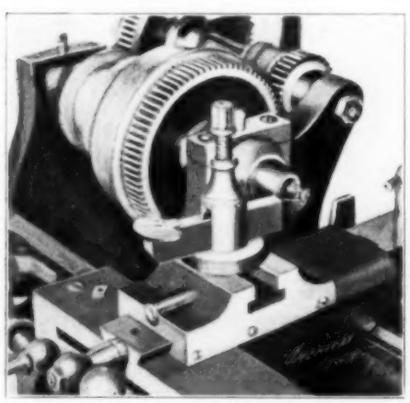


FIG. 2. TESTING SPINDLE HOLE.

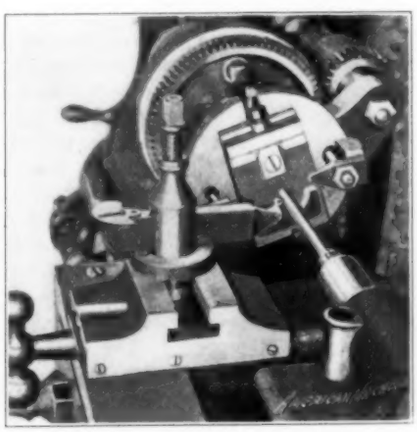


FIG. 3. LOCATING A JIG.

Railroad Brass Founding.

BY C. VICKERS.

In a former article on brass founding, at page 1400, the writer spoke of the method of making car journal bearings. Another well-known piece is the connecting rod brass. This may be cast with the bearing up or down, as fancy may dictate and the finish of the patterns will allow. Some founders will not hear of any bearing being cast with the concave part uppermost, because if there is any dirt in the alloy, or any sand cut from the mold by the wash of the metal, it will rise to the highest point to the detriment of the casting. With clean metal, however, the risk is so small that some manufacturers habitually take it, and apparently without regret, as it is a much easier way of making these castings. In fact, if the pattern is ill-made and will not draw from the sand without loosening the same, the "bearing down" process becomes very expensive in molder's time, because of the patching and slicking necessary to bring the mold to shape, and the amount of nailing required to hold it together while being closed, so that in some shops the condition of the pattern determines the manner of molding, and in case any defects develop while machining the bearing of a rod brass, which has been cast bearing up because of a rough pattern, the customer has no one to blame but himself.

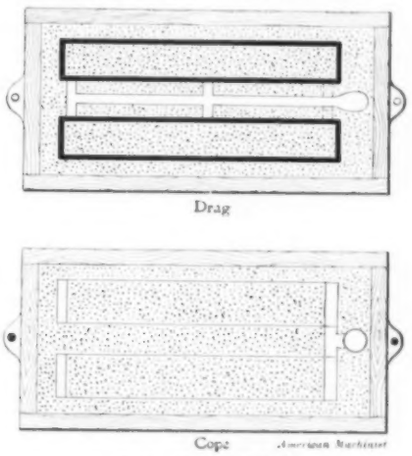


FIG. 1. MOLDING GIBS.

Another brass casting used on locomotives is the gib or slide. This is a narrow slab of bronze, from one-half inch to an inch in thickness, and sometimes with sides added so as to resemble a trough. These trough gibs are better cast with the inside of the trough downwards, as it dispenses with the soldering that would be necessary to hang the body of sand that forms the inside. As these castings range near an inch in thickness, they may be run by a gate at one end, provided such gate is cut to form a continuation of the sides so that the metal falls into the channels made by the same, and so, after filling them gently, overflows the green-sand core. When the gibs are gated in the center at one end and the mold inclined

(a practice often followed by careless molders) scabbed and dirty work is frequent, because the metal washes over the core and cuts it away. In both these methods of gating, the metal flows through the mold and runs unconfined over a surface it must finally rest upon, to the evident disadvantage of the same, so that it is preferable to convey the metal by means of a runner to the lowest point of the mold, the same being inclined, and thus permit the metal to flow upwards until the mold is filled.

As shown in Fig. 1, there are three gates used, one at the lowest end, one in the middle, and another at the upper end near the sprue, this last one being cut in the cope only, the idea being for the metal to pass this gate because it is above the level of the runner, down which it rushes and enters the mold at the bottom. The middle gate is really not necessary, but is put there in case the metal should be a little cold, when it becomes a material aid to the success of the casting. The upper gate is connected by the enlargement of the runner, cut in the cope, to the sprue, thus allowing the sprue to feed the casting and prevent any shrinkage.

It is always a good idea to use a facing on the pattern when ramming the nowel. This facing may be made by mixing one part of flour with fifteen parts of sand; the green-sand core should also be well vented. A good plan, after bedding on the bottom board, is to remove it and cut a channel in the sand over the core, then thoroughly vent the same with a thin wire, and before replacing the board to close the vents

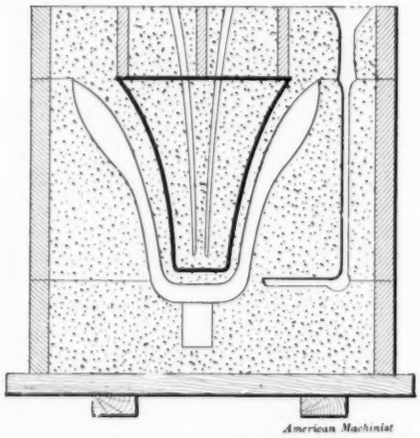


FIG. 2. CASTING A BELL MOUTH UP.

in the channel by rubbing them over lightly with the fingers, thus preventing a bottom "run out." With the smaller flat gibs the same manner of molding may be adopted and will give cleaner results than the ordinary end gate.

Another casting much used in railroad shops is the "stick." This is a round or hexagonal bar of brass, and is cut up into nuts and washers. Such bars cause trouble to the inexperienced molder only, when their diameter is 2 inches or more; then they exhibit a tendency to shrink. There are two ways of molding sticks: horizontally and vertically. The horizontal method is always used for the smaller sizes, and calls for no comment. With the large sizes there is an unfailing rule to prevent shrinkage, and that is to make the sprue or feeder of a diameter slightly in excess of that of the pattern. This will produce the nicest work, as the metal may be poured comparatively cool, thereby preventing fins and other roughnesses. Many

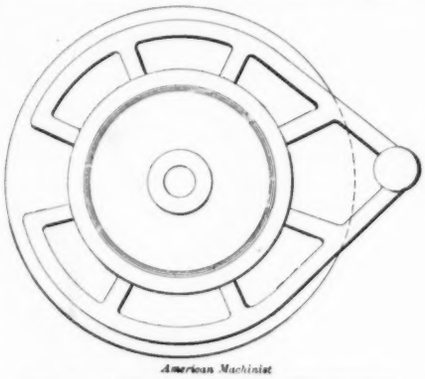


FIG. 3. GATING A BELL ON THE CROWN.

foremen, often through sheer ignorance, object to such large heads, regarding them as a waste of metal. In such cases where a sprue smaller in diameter than the casting is used the metal must be poured exceedingly hot to avoid shrinkage, with the result that the castings come out rough and covered with fins, and the cost of cleaning is greater than the cost of melting the additional metal required by the larger sprue. Add to this the danger of using the metal a little too cool (for it is human to err) and the consequent loss by shrinkage, and the fact that more is lost than gained by such pennywise methods will be apparent.

There are two ways of gating the vertically molded stick: the bottom gate and the top gate. When the stick is bottom gated a riser must be taken off at the top to "hold it up"; with the top gate this is unnecessary, as the gate itself performs that office. For this manner of molding the sand must be used much dryer than for ordinary work, and it must be rammed sufficiently hard to prevent the casting swelling, and yet not so hard as to cause the mold to blow. With the horizontal style of molding sticks, shrinkage is almost the only thing to be guarded against, and that, as outlined above, is easily overcome.

To the danger of shrinkage the vertical method adds other perils. The sand may be either too wet or too dry, and it may be rammed too hard or not hard enough; therefore I believe the horizontal molding of such sticks is to be preferred.

One of the most important bronze castings used on the locomotive is the bell. The average engine bell weighs from 75 pounds to over 100 pounds in the rough. The small bell used on some switch engines weighs 46 pounds. The cleanest way of making a bell is to hang the core; this method of molding is illustrated in Fig. 2. To successfully hold the core an iron skeleton should be bolted to the cope. The core must be well vented, and to prevent accidents wooden slides should be used at the joint of cheek and cope. They must be of a length sufficient to insure against the core scraping the walls of the mold when closing.

A common way of molding a bell is to place the pattern mouth downwards on the follow-board, and over this is placed the cheek (a three-parted flask is used) cope joint down if the bell is to be made mouth up. The gate-stick is placed in position and the cheek is rammed tolerably hard, with sand a little dryer than ordinary. A parting is made at the crown, the drag is rammed and the whole then inverted. The parting for the cope is now made and the cope, with skeleton, is placed in position. A sprue stick is placed on the one in the cheek and the cope is rammed and vented. The cope with core may now be lifted off, or the mold rolled over and the cheek and drag removed, whichever is considered safest. After the pattern is withdrawn the cheek is lifted off the drag and the gate-runner is cut in the same. The runner should almost encircle the crown at a distance of a couple of inches from it. The gates should be cut into the crown at regular intervals. See Fig. 3.

These gates must be carefully cut. They may be about an inch in breadth, and as thin as possible where they join the casting—an eighth of an inch at the deepest part is the maximum depth. The object in making the gates thin is to prevent

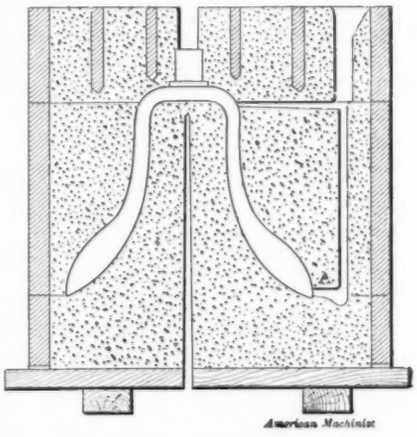


FIG. 4. CASTING A BELL MOUTH DOWN.

breaking in, as bell metal is very apt to do. The metal should be poured cool, as it runs very sharp.

The easiest way of making a bell is shown at Fig. 4—that is, mouth downwards—and it is the method generally adopted in making church and other large bells cast in loam. With green sand, however, unless the mold is very skillfully rammed and the heat of the metal on pouring is skillfully gaged, the casting is very apt to be much strained and distorted at the bow, because the shape of the mold

at this part allows the metal to act as a wedge as long as it remains fluid. As shown at *A*, Fig. 4, the gate is extended to the bottom of the mold. Such a gate has the disadvantage of being liable to break a piece out of the bow, if not handled very carefully. To avoid this, bells cast mouth down are quite often gated into the crown only, as in Fig. 3. The metal thus strikes the top of the core and often cuts it off, to prevent which the core may be dried. A very good idea in making locomotive bells is to make the core and dry it separately, and after the mold is made bolt it to the drag or hang it to the cope, according to the method of molding followed.

Notes by a Wandering Mechanic.

A TURRET LATHE ATTACHMENT FOR TURNING AND FACING CHANGE GEAR BLANKS—MILLING THIN STEEL PIECES—MILLING BOLT HEADS.

BY H. GOLDSMITH.

The next shops which I had the good fortune to get into were those of the Pratt & Whitney Company, at Hartford. At that time their 14-inch manufacturer's lathe was just being placed on the market, and a few were in use in their own shops, and maybe they couldn't hog off the metal on their crucible steel spindles—naturally using plenty of soda water in the operation. Each department there is entirely separated from the others and has its own planers, lathes, screw machines, milling machines, etc. In their heavy milling department some very fine examples of large gang milling could be seen on the frames of their automatic machines, these being machined accurately and rapidly. Such parts as lathe headstocks, steady-rests, caps for headstocks, etc., were also being handled on the milling machine. In their automatic screw machine department some very surprising results were being obtained on castings in their magazine machines. To me this work seemed something marvelous, but, like everything else, one becomes accustomed to it in time. It seems to be second nature to a man in this country to accustom himself without the least exertion to the rapid strides that are being made in mechanical devices and shop methods.

There are a great many special tools and attachments at the Pratt & Whtiney shops, and a few are shown in the accompanying sketches. Fig. 35 shows a hand turret lathe arranged for turning and facing change gears. The turret head is removed from the slide and in its place is bolted a casting *E*, carrying the slide *A* and the plate *F*. In the slide *A* are secured roughing and finishing tools for turning the outside diameter of the gear blank. This blank, the hub of which has been bored out and faced in a previous operation, is held on a plug inserted in the taper hole in the spindle. A short pin secured in the face-plate engages with one of the arms in the gear and acts as a driver. The block *C* attached to the top of the front bearing cap of the lathe, acts as a steady-rest and support for slide *A* while the turning tools are at work. The block B carrying the two tools for facing both sides of the gear blank is operated by means of the plate *F* passing through the lower part of the cut-off rest. This plate is provided with a groove, as shown at *G*, in which fits a roll carried on a pin secured in the under side of the cross feed nut. The operations of turning the outside and finishing both sides of the gear blanks are thus controlled by the forward movement of the turret slide, and both operations being performed simultaneously, considerable time is saved over previous methods.

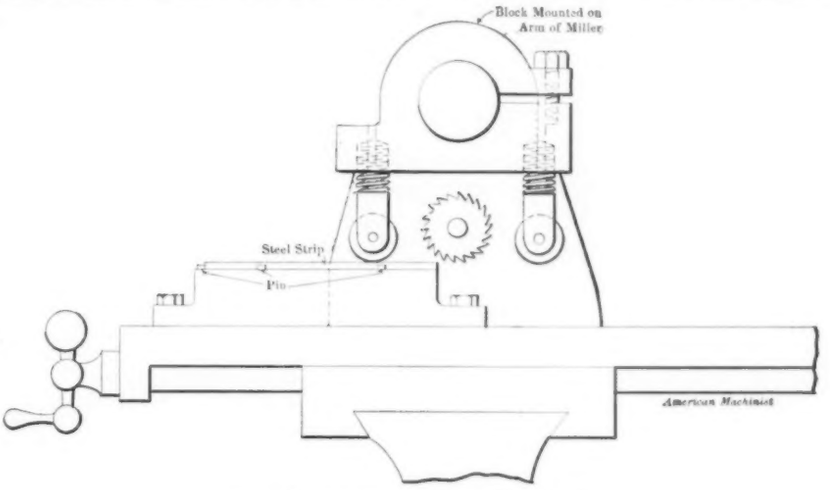


FIG. 36. MILLING THIN STEEL PIECES.

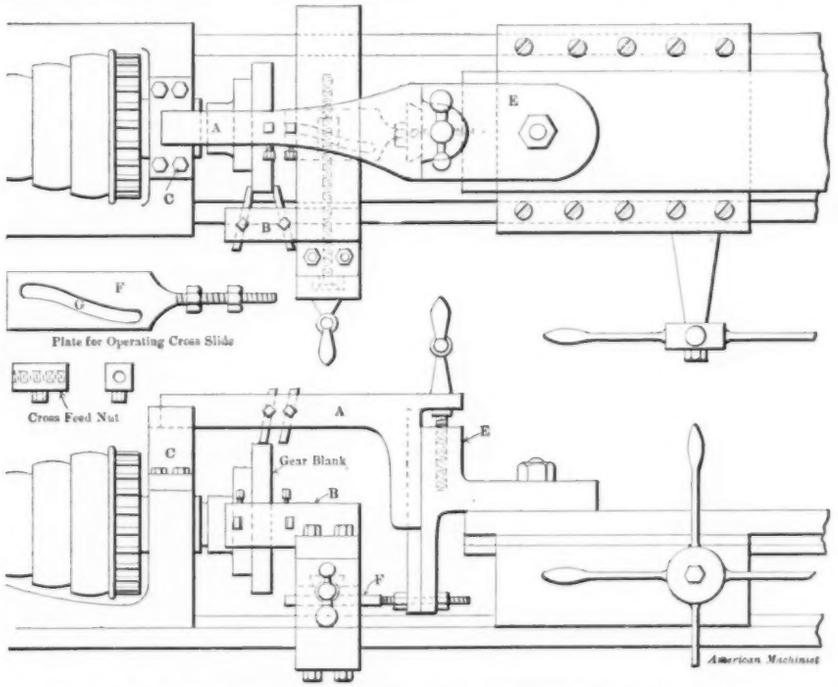


FIG. 35. TURRET LATHE ARRANGED FOR TURNING AND FACING GEAR BLANKS.

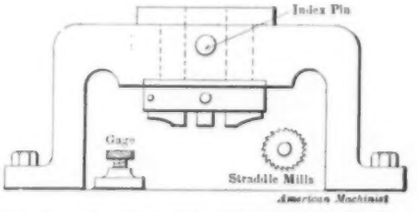


FIG. 37. FIXTURE FOR MILLING BOLT HEADS.

The fixture shown in Fig. 36 is a very good one for holding down thin blades of steel while milling, the rollers carried at either side of the cutter being forced down on the work by springs as shown. A very rigid fixture for holding bolts while a square or hexagon head is being milled is shown in Fig. 37.

In the small tool department of this firm there are some very fine special machines for grinding the clearance on milling cutters, saws, etc., and other special machines for making punches, dies and

taps. They have also some special turret lathe attachments for drilling and tapping the holes in dies, and for drilling the clearance holes to allow the chips to pass out while the dies are cutting.

While at work for this company, a firm I had previously worked for that made a specialty of turret lathes, wished me to become a salesman for their New York office and introduce their machines. I accepted the proposition they made, receiving more salary and getting the opportunity to gain experience in another line—that is, selling machinery—and for a considerable time I have been holding down this position, my practical experience naturally being of considerable service to me in this work.

In finishing this description of my trip, I wish to add that when I started out I felt that I would have to battle with many problems and meet many adverse conditions, and as these difficulties came up in my travels I found considerable pleasure in mastering them. The experience gained in meeting such problems and the coming in contact with so many different fellow-workmen enable one to broaden out and meet conditions, as they present themselves, with perfect confidence. But I would not advise anyone to take a trip of this character unless he is perfectly capable of reading drawings and familiar with almost all kinds of machine tools.

The Koopman Calipers.

BY FERD. WERTHEIM.

Micrometers and other refined measuring appliances are everywhere in every-day use, but the spring caliper and the firm-joint kind, recently much improved, are being called for and produced in greater quantity than ever. They have their own field, and the changes in shop methods have not brought about their retirement.

I have thought that a description of several calipers, which used to be held in high esteem by toolmakers and the best machinists, and are superior to anything on the market to-day, would interest AMERICAN MACHINIST readers.

The tools illustrated were brought out about ten years ago by A. F. Koopman, of Chicago, and patents were applied for.

Fig. 1 shows the strap-joint caliper. This was made of saw steel, and the points were really finished—one did not have to doctor them before they were fit for use, as with most of those now for sale. The joint was perfect—the steel straps and solid bronze ring giving a friction absolutely free from back lash—and so made as to be readily adjusted. One could hold these calipers by inserting the small finger in the bronze ring *A*, or they could be hung up thereby. These strap-joint calipers were notable for their extreme stiffness and lightness.

Fig. 2 shows the combination caliper. The construction of the joint (called a plug and thimble joint) is shown in Fig. 3. The caliper points are finished to a thin, flat point, and hardened, making the tool valuable for the most accurate measurements. The usual binding clamps or thumb-screws are done away with, and all the points are taper at one end, fitting sockets in the head, friction being depended on to hold them.

I am not sure how this construction stood the rough-and-tumble usage of the shop, but offer the suggestion that it is a very good way to make the better grade of drafting instruments.

The folding wing *W* is especially neat. The quadrant on ordinary dividers or combination calipers sticks out "like a sore thumb." It is often in the way of the fingers when using the dividers for stepping off; it takes up too much room in the tool box, and requires springs and check-nuts to keep it steady. The folding wing *W* opens and closes automatically with the tool, and a fine positive adjusting movement of the leg is secured by the eccentric nut *C*. This nut has a taper bearing to take up supposable wear.

These tools are as simple as any on the market now. They were brought out by a small and poor concern, but if manufactured to-day by a firm equipped for the work their excellence should assure a ready and abundant sale.

The importance of the workman's small tools, both to himself and to the shop, through the results so largely dependent upon them, justifies almost unlimited discussion of them, and many should be interested in the tools to which I here call attention.

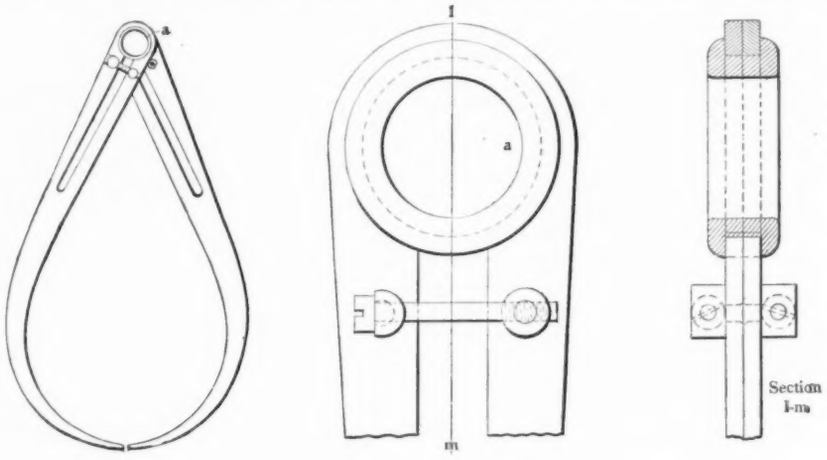


FIG. 1

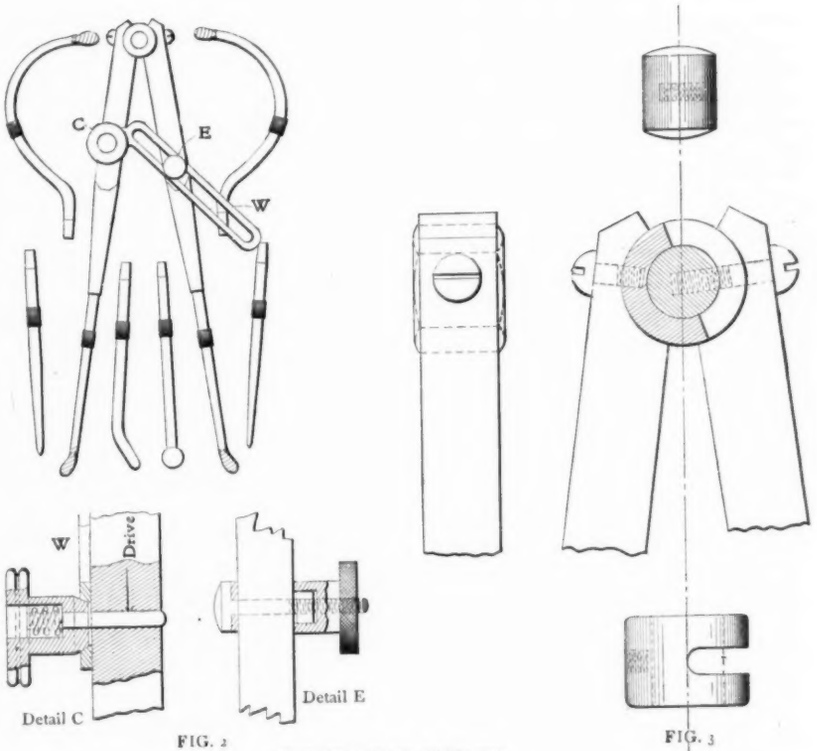


FIG. 2 FIG. 3

THE KOOPMAN CALIPERS.

American Machinist

Foundry.

BY R. H. PALMER.

As one considers the past quarter of a century of foundry advance, many improvements are noted, particularly in buildings. By many firms more attention was given to plants and machinery for turning castings into machines, twenty-five years ago, than to the production of the castings. Little was understood generally of the difficulties encountered by the foundrymen, and little attention was paid to their needs. As the production of machinery became systematized, and the machinery became more perfected, many of the difficulties encountered in the machine shop became more and more traceable to the foundry. As these facts became more apparent, the attention of machinery manufacturers was attracted more to the foundries, and as they gave more attention to the foundries, the needs of the foundry became understood, and some of its difficulties better appreciated.

One of the first points to attract attention was the lighting, and the question was asked, "Why should my machine shop require so much light and my foundry be obliged to get along with so little?" The engineer and architect were called upon to produce a better constructed building and one more convenient. The dark, dismal foundry buildings gave place, as modern foundries were erected, to those better lighted. The problem of heating was worked out in many ways and different systems were installed. Better sanitary appliances were installed and ventilation provided for; wash, bath and dressing rooms were provided, adding to the health and comfort of employees.

With the foregoing awakening came also another to the fact that the country was calling for a line of goods requiring heavier machinery to produce it, in many cases. Foundries had been erected which the owners considered were capable of having made in them castings of any size wanted, but it was found the castings were costing too much, even where they could be produced at all, and the foundry had not proper facilities for handling economically the size of castings required; too much manual labor was employed; too much power expended; neither of these of the right kind, or in the right way.

Cranes of the most improved pattern, with other lifting devices in different forms, had been installed in the machine shop. If it paid to expend money to save money in the machine shop, why should it not pay to do so in the foundry? became the question. Since the time when that question came to be asked by the owners of foundries, improvements have been continuous.

The style of foundry building became the style adapted to the owner's peculiar needs, and its situation. The handling and storage of supplies attracted his attention, and different ways were provided, in close proximity to where they were to be used, to escape extra handling and its consequent cost. The ever-present danger of fire in wooden buildings caused brick and steel to largely take the place of wood. The old-style foundry was, in general, low-studded, and seldom gave hoist room enough to have what were then called heavy castings made in it conveniently. With the installation of the traveling crane came the need for greater hight between floor and truss—more head room.

Of the many styles of buildings, the foundry with main floor through the center, or "Monitor" style, and side roofs, r wings, with traveling cranes in the monitor, and jib cranes working on the posts swinging in under the wings and into the main floor, seems to give best satisfaction for the combination of heavy and light work. The arrangement of cupolas is governed by the situation of the building, delivery of iron and coke, etc. Some of the latest foundries built have been, not the embodiment of the ideas of one man, but the assembling of the ideas of many, and the selection among these ideas of those which the builder considered as being the best adapted to suitably and economically produce his particular and individual class of work. To this end some men have traveled extensively, visiting the most improved foundries in the country, and from the experience of others have striven to produce the most economically and conveniently arranged foundry plants possible.

The advent of the traveling crane in the foundry was thought to "doom" the jib crane, and its banishment was predicted; but it was found the traveling crane needed help. While a giant in strength, it could not be everywhere at one time, and was needed at too many points at the same time. Hence the arrangement of jib cranes on the posts of the monitor, as accessories to the traveler. To-day the styles of cranes and kinds of power applied to them are many. In connection with jib cranes, air hoists and other devices have been installed. Industrial rail or tram ways have been laid to facilitate the removal of castings from foundry to cleaning room, and rattlers.

The cupola for melting the iron has been the subject of many exhaustive discussions. In many parts of the country coal was for years used for melting, and among the older styles the McKenzie was quite a favorite, though the straight cupola with the designer's special tuyeres was perhaps the most common, with windbox on the outside; all aiming at the important points—an even and complete combustion, giving and maintaining a high degree of heat to melt the iron, with as little fuel as possible. Coke has largely superseded coal, as experience teaches us it is more economical than coal with the improved cupolas of to-day, although some of the foundries prefer the combination of both, claiming the iron lives longer, is cleaner, etc. On the other hand, a cupola built to use coke alone, with a special arrangement of tuyeres, is perfectly satisfactory in its workings, provided it has the proper quality and quantity of coke and the right amount of wind, and with proper facilities for slaging may be run for a considerable length of time. Melting with coal alone was a slow process, and one accustomed to melting with coal and changing to coke finds the time required to pour off the shop considerably shortened when he becomes accustomed to the use of coke. When coke was used exclusively in a place where coal was formerly used, the cry usually was, "The lining cuts out quicker"; but the manufacturers of the lining have been able to meet that. Regarding the blowers of years ago: I have heard a number of styles alluded to as "tub" blowers, and with different arrangements of valves, but never had the good, or ill, fortune to see them in operation. I once saw a small, home-made blower, or fan, running a small cupola, the sides of the case being made of boards, the circular part covered with light sheet iron, while the fan running inside was built on a wooden shaft. It did the work. In these days, trouble with the blower is almost unknown.

I have referred to the cupola. What goes into it is one of the most important points. We sell its product molded into various forms, called castings, and upon their cost and quality depends the profit. The quality of iron charged, fuel it is melted with and our management of the cupola, all go together to help determine the quality of the iron.

One of the greatest strides in conducting a foundry plant successfully has been the recognition by owners and managers of the value and importance of chemistry in connection with mixing the iron, and a chemical analysis of iron and fuel and analysis of product; also the importance of physical tests in conjunction with the latter. Not many years ago the mixing of iron was done largely by rule of thumb. Physical tests were made and the mixture changed if not satisfactory, by adding a little iron of what looked the softer pig, when perhaps the cause of all the trouble was too large a proportion of that very iron. The next run showed the trouble to be greater; another change was made, and finally the trouble was solved for the time—by what? A lucky chance. With the aid of the chemist it is known what goes in; with his aid and physical tests, it is known what comes out, and few mistakes are made. But it is to be remembered that an improperly charged cupola producing a slowly melted, slack iron never produced clean, soft machinery castings. Hence the importance of a properly managed cupola is realized.

When a foundry is built on a level piece of ground, the elevation of the fuel and iron to the charging stage has been given a great amount of attention. In

years gone by it was done by a man wheeling it up a runway or throwing it from the ground on to an intermediate stage and then from there to the charging stage. While that may do in a small way, the large plants melting 50 to 150 tons per day have provided elevating systems, at considerable expense, to economize manual labor. The consequence is that a large amount of fuel and iron can be handled at a minimum cost. This and other papers have published very interesting photographs of the systems these larger foundries have in use.

Formerly the iron was taken on to the charging floor and then the charge was made up from the different piles of iron assembled there, and tossed from scales into furnaces or cupola; in fact, in some old foundries, it was a question how much was weighed on the scales, and perhaps in some places it is now. The larger firms have now so arranged their systems of handling the stock that a charge is weighed upon a car in the storage yard, pushed over to the elevator, and up it goes to the stage and forms one of a train that is to pass before and be discharged into the cupola at the proper time, thus doing away with extra handling. And some have arranged to carry in store, on the stage, a whole, or part, of a day's needs in case of accident to the elevating machinery. The number of elevators and the different styles are many, and each has its friends, but the plunger elevator is quite a favorite; perhaps the more so as so much water is needed at shaking-out time in the foundry, and the water from the elevator can be utilized, if properly stored; but each possesses some advantage over the other.

Lighting the foundry by artificial means was a problem in times gone by. Some of the ways resorted to were: Filling a pail with sawdust and saturating it with kerosene; another, pouring some melted iron in the sand, covering it with coal with gas pipe stuck up in the center, covering the coal with sand, and lighting the escaping gas. A gas light usually looked like a "bug-light" a short distance away when the foundry was filled with gas and steam when pouring off and shaking out the molds. The introduction of the electric light was a blessing; it can penetrate the fog in the foundry at the times referred to. At first it was thought a few lights would do, but experience proved it required more in number, so arranged as to overcome shadows Deprive the foundries of the electric light and the loss would be keenly felt.

Compressed air is being used in many ways in the foundry, and many claims are made for it as an economizer. The air lift has been in successful operation, and also for some time a pneumatic hammer, and it is fast gaining friends, as it proves its efficiency.

Years ago, when the riddle, or sieve, was used by hand alone, it took quite a long time to riddle a pile of sand, as many an apprentice boy knew. A rude machine, known as a "one-legged horse," was made. Next came riddling machines of different styles and then a sand mixer for tempering alone.

The molding machines of to-day are far in advance of those of former years, and many castings are made on them that only a few years ago it was deemed impossible to make. Constant improvements are being made and in this age of perfected, special machinery, there are many surprises yet in store for many foundrymen. With the need of a greater and more economical output, why should it seem at all strange that the attention of the inventor should be attracted by the wants of the foundry? Does it not show a field for inventive genius?

Handling the iron has received a great deal of attention. In former years the large ladles were poured by the use of levers. During the past twenty years the ladles have been improved, being better balanced and shaped, and arranged with gears to be worked with a wheel to lift them as they are used in pouring. Ladles holding up to twenty tons or more can be obtained, which can be worked very easily and with safety with less help than a six-ton ladle could twenty-five years ago. The foundries where what is termed "side floor and bench work" is made have provided ways of carrying the iron from the cupola around to the side floors and different parts of the foundry, and delivering it into the smaller ladles used by the molders. The same systems are in use in the shops making heavy and light work in connection with cranes or cupola. Some of the systems are, ladles mounted on trucks running on tracks; also a ladle mounted on two wheels pushed along a gangway paved with iron plates, or an overhead system of tracks from which a ladle is suspended from a carriage running on that track. Each has its advantages. Some of these systems are quite expensive, yet prove very economical, especially where there is a great deal of iron to be handled. In most foundries the custom had been, and is still in many, for the molder to take his iron directly from the cupola with the help of a laborer or molder if needed; consequently, there is a cost for what may be termed non-producing labor, which with any of the above systems is reduced to a minimum, as two men can handle a large amount of iron.

Core ovens for drying the large loam and dry sand molds, also the large cores, are varied as the wants of their special foundry demand, in style, arrangement of flues, fireboxes and general form, yet in all keeping in mind the necessity of an evenly distributed heat throughout the oven. One of the great difficulties in many has been to get an oven to bake or dry the cores well at the bottom; hence the application of bottom heat, or placing of fireboxes in the floor. The smaller ovens show more styles and are arranged with a number of improvements, as the shelf swinging out with guard at back closing the opening, saving heat and protecting the man; and heat diffused through the oven by a system of piping, to economize fuel. Many cores that were formerly made in halves and pasted are now made whole, insuring a round core, if that be the style. Especially is this important in the production of steam and gas pipe fittings and many machine castings as well. Many styles of carriages are in use, and in connection with the heavier, arrangements for the traveling crane, to pull them out of and into the oven.

The cost of flasks is one entering largely into the cost of equipment of the foundry, and is determined by what kind of castings the foundry is to produce. The flasks for green sand, which perhaps is the most important in one sense, were formerly made about all of wood, in this country. The kind of wood that was cheapest and easiest to obtain was the kind generally used in the jobbing foundry in any locality, and the wooden flask to them is a necessity, as it is easily made, and bared to fit any style pattern, is easily altered in depth, number of parts and size; but as foundries became specialty foundries, producing castings for special lines of machinery, it became more economical to make iron flasks conforming to the outlines of the patterns; thus reducing the amount of sand to be used by the molder and giving him a chance to produce more castings without an increased amount of labor. With their introduction into the specialty foundry, many jobbing foundries devised flasks of iron that were so constructed that the parts were interchangeable to a certain extent. The introduction of the large and powerful molding machines still added more, and iron flasks became a necessity to green sand as well as dry sand.

The loam molder still uses the spindle and strickle, or strike, and his plates, bricks and loam. Improved ways have been introduced of securing his built-up mold, and new wrinkles introduced.

With the improved facilities for handling work inside the foundry, provision was made to bring flasks into and out of the foundry by other means than a large expenditure of manual labor and its consequent cost in handling the larger flasks. Industrial railways were laid and trolley systems installed in connection with modern foundries, and two men can now do as much as twenty in the old way. Another important item to most foundries is the storage of flasks—in the city especially, where feet of ground mean dollars—hence the necessity of flasks that can be easily altered and adapted to the prevailing style of work.

In the cleaning room the compressed air chipper is doing the work of a number of men. I can only say, if more would try it I think their experience would satisfy them that it is just the thing. The sand

blast, it has been claimed, was to fill a long-felt want. There are those who don't want it; but what satisfies one does not all. In the above I refer to the larger class of castings. For the smaller castings the tumbling barrel is still the most economical.

In the large foundries there has been a system of systematizing of the foundry departments. Work that is to be done to-morrow is laid out to-day; certain molders know just what changes are to be made, and the flask currier knows what is wanted. The old style of "we must have this to-day anyway" has given place to "make it if possible, but don't break things up and add to the cost of other things to get this one." Economy is the word. If, owing to the forgetfulness of the one who should have ordered the casting, it is not on hand when the machine shop wants

The Machinist and the Modern Lathe.

One of the interesting sights of a modern American machine shop is to watch the working of a lathe. It moves with unerring precision, shifts at the right moment and, once started, the machinist can with safety glance at his paper, knowing that the machine will almost think in performing its task.

[Fac simile from the *Detroit News-Tribune* of November 16. Comment unnecessary.]

it, he cannot rush into the foundry and order it in right away, breaking everything and everybody up; his order has to go on where it is going to show and can take its place. Should a breakdown come in, that may be different, and mean rush.

Instead of molders placing their smaller castings in the gangway and cutting over their sand, men come in during the night who remove the castings and cut over the sand, the molder only shaking out the smaller work and leaving the larger so as to avoid damage to flasks; or perhaps there may be some reason for a molder to stay to look after some particular job, but the idea is to let unskilled labor do what belongs to it, and economize in the amount of it, by emplo ing power, where possible, and in this way economize in skilled labor and let the time saved to the molder be turned into production time.

In order to facilitate the cleaning of castings and to withstand the effect of the hot iron on the mold, the face of the mold is made of a mixture of sand and sea-coal facing, varying in proportion to the weight, thickness and other peculiarities of the casting to be made and the face of the mold is brushed or dusted and slicked over with preparations of Ceylon 'ead; formerly other preparations were used, as a patent facing called mineral and a mixture of Lehigh coal, charcoal and other non-conductors of heat, mixed by the molder according to his experience and fancy, to make the casting peel off, keep it from cutting, etc. In former years this was done in the case of the larger castings, but as years passed in many parts of the country it became the custom to make most of the work on the floor for machinery castings "in facing," as it .s termed, and the pickling of castings became less common. The smaller castings in most cases, when possible, are rattled or tumbled. While this way is without doubt the most economical, yet the claim is justly made that the process of tumbling the smaller castings that are to be machined causes a harder scale to be formed on the surface, while pickling tends to soften it. Hence, in many foundries making such work as cotton machinery, very little sea-coal facing is use' and care is taken to sort out the castings that are to be machined and pickle them.

The dry-sand molder and loam molder made his damp-blacking from mixtures of the foregoing ingredients, using some beer and a little clay to help stick the blacking. To-day molasses water is in general use all over the country for the general purposes mentioned, and by the coremaker. Where in years past the raw material alone was furnished, to-day we have the foundry supply house, ready to furnish us with everything we wish to use.

Much annoyance and the loss of castings was caused by the blowing around chaplets; in other words, the iron not lying to the chaplet, and many were the devices employed to overcome this. To-day the greater number of chaplets, where they are used for steam work, are tinned and the metal in this way is fluxed on to the wrought chaplet as the molten metal runs around it.

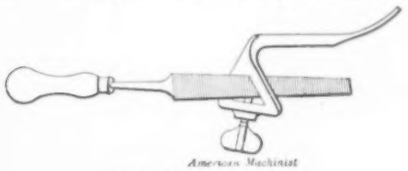
While the art of hand molding remains the same, it is surrounded with the many improved accessories named and is carried on in pleasanter shops, with more comforts, and in many places more than comforts, of the modern shops.

Letters From Practical Men.

Attachment for the File.

Editor American Machinist:

The enclosed sketch shows a tool which I have lately designed and found useful for a variety of work. As you will see,



FILE ATTACHMENT.

it is an extension or attachment which can be fastened to any shape of file when it is necessary to use the extreme point, as in sharpening reamers, etc. It thus allows the full pressure of the left hand to be employed, with the addition of greater leverage. I hope this idea may be of use to some of your other readers.

A. PRINGLE.

Planing "Out of Wind."

Editor American Machinist:

I can quite endorse Old Bob's remarks at page 954 on the time-wasting use of "winding strips," but I would ask "Why use a straight-edge?" For my own part I have not used "winding strips" for years or a straight-edge either, but merely turned the board edgewise, when the wind can be detected by the eye without further trouble. I have never found the least difficulty in doing this sufficiently accurately for any work that I have ever had to do with, and I constantly plane up work for "rubbed" glue joints and "paper" joints.

By having the sharpness taken off the corner of the try plane, it makes a very efficient straight-edge for planing the work straight across, and working in this way there is no need to lay down the plane until the work on that side of the board is finished. Of course, with a thin board

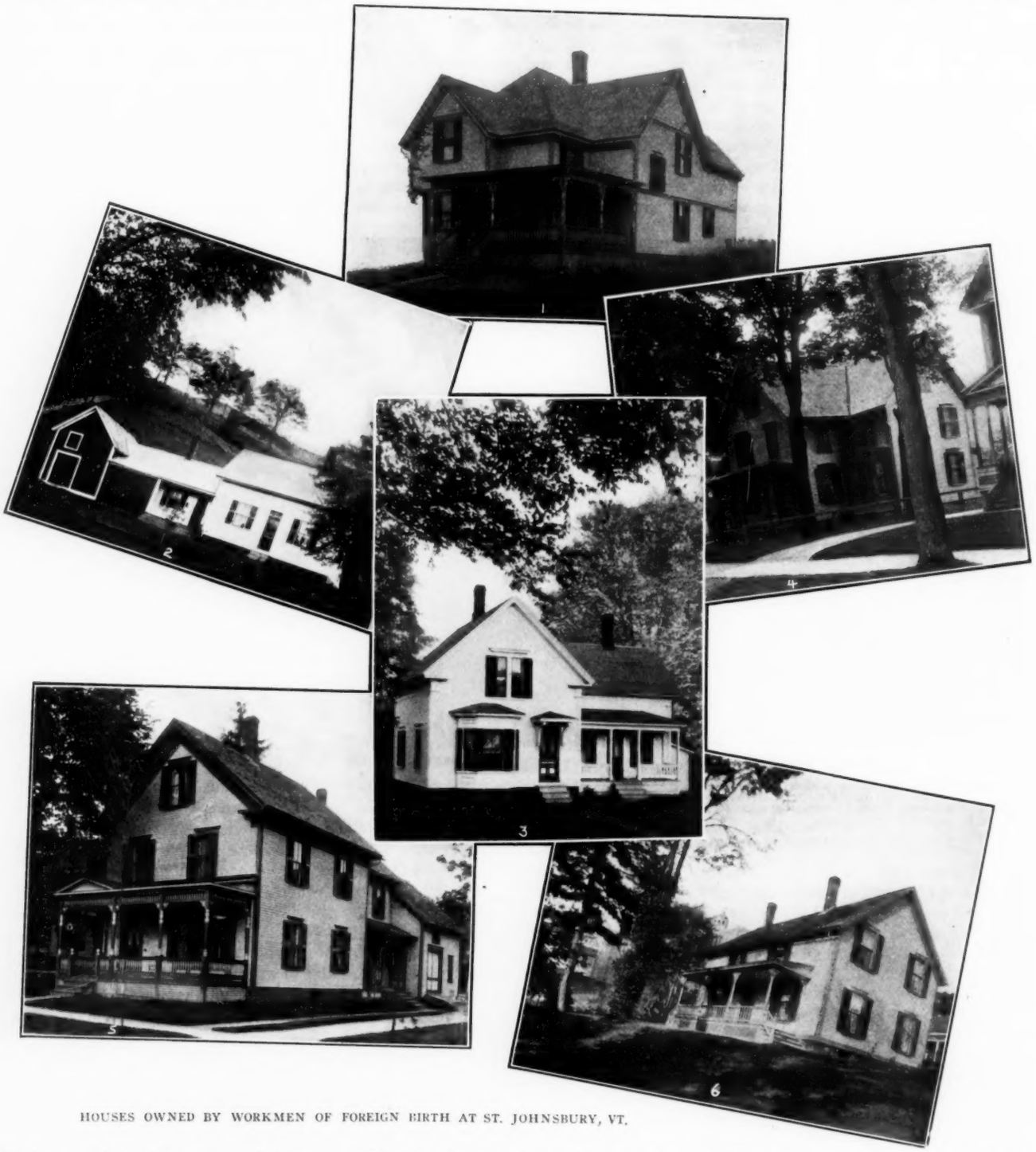
it is often as well to roughly straighten one side of the board so that it will lie on the bench without springing, but this can be done with a jack-plane to much better advantage. W. E. D.

State of Victoria, Australia.

The Strangers Within Our Gates.

Editor American Machinist:

I am sending you some photographs of the homes of foreign-born workingmen, taken in St. Johnsbury, Vt., to show the contrast between these houses and those of an Italian settlement shown by Mr. Tecumseh Swift at page 641. St. Johnsbury is an old-time New England town, and, although the foreign element comprises about one-third of the population, it still retains much of the New England spirit. Foreigners are here quickly assimilated and become good and patriotic Americans. Many of them own their homes, and all take great pride in their care of the house and lawn.



HOUSES OWNED BY WORKMEN OF FOREIGN BIRTH AT ST. JOHNSBURY, VT.

Of the photographs, No. 1 shows the home of a young Swede. He is now a packer in the scale works. He came to this country when fifteen years of age. At that time he worked for my father, and finding him wholly illiterate my mother taught him to read and write. Being deprived of much education himself, he more keenly perceived the advantage which educated people possess, and his children have all received a liberal education at the public schools. Himself an Irish Catholic, molder, but he came here with no trade, no knowledge of our language and almost no money. He had no "pull," nothing to help him except diligence and perseverance.

No. 2 is the home of an Irishman, a unable to read at the age when many boys are through school, he has now two daughters in an academy, one son fitted for college and one other son through college with class honors and holding a professorship in a Massachusetts school. He,

together with all the others mentioned, *own* their homes.

No. 3 is the home of another Irishman, a blacksmith. In Ireland it is said that only one man out of seventy-eight *owns* his home. This man would resent it, however, if I called him an Irishman, or even an Irish-American, for in his public speeches, which he is often called upon to make he never fails to declare that he is a "free American citizen."

No. 4 is the home of still another Irish-born citizen. For fifty-five years he has been a molder in the Fairbanks foundry. Although beginning as a poor boy, he has by hard work been able to accumulate a fine property on the best street in town, to afford his daughter a chance to cultivate her musical talents and to give his son a legal education, and finally to retire after having fully done his share of hard work.

No. 5 is the home of a Swedish blacksmith, who has been an American for twenty-five years. Although the Swedes are natural-born ironworkers, there is little inducement for skilled laborers to come to this country, since anyone importing a workman with the promise of a job is liable to a fine of $1,000 and the workman to be deported. This man came here from Sweden unskilled, without work and with no unusual chance. By diligence and economy, he has been able to earn enough to support his family, and, in spite of more than the usual amount of sickness, to save enough out of his earnings to own a home. His daughter has just graduated from one of the leading New England academies, valedictorian of her class, ranking first in a class of 60.

No. 6 shows the small but comfortable home of a French-Canadian. The French church and parish school can be seen through the trees on another street. This man's premises are so neatly cared for as to attract attention from people who pass by.

These houses are all owned by men of foreign birth, workingmen dependent on their day's labor for their support. There are arriving in this country more than 100,000 such people every month, and the number is constantly increasing. More than half the immigrants are men, and half of the men are illiterate. These people enter at once into our commercial and industrial life. They must live and our prosperity must support them. None of them begin life here with any greater handicap than some of these men I have mentioned, since cripples, paupers and others not able to earn a living are rejected by the board of immigration. Some of these men will be pursued by ill-luck, sickness and other misfortunes, so that they will be unable to own a home; others will be content with a shack like those shown by Mr. Swift, while others will have comfortable homes like those illustrated in this paper. Which kind it shall be will depend much on the environment. W. H. S.

Planing a Large Bed Plate on a Small Planer—An Attachment for the Shaper.

Editor American Machinist:

The sketches show some ideas found in a nearby shop. Fig. 1 shows a method of planing a large generator bed plate on a small planer. *A* is a circular table taken

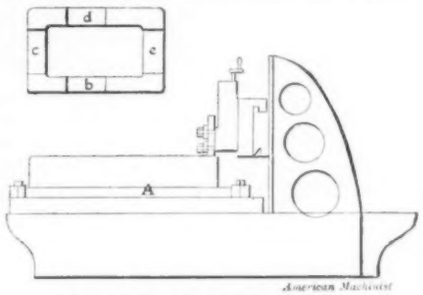


FIG. 1. PLANING A BED PLATE.

from a large horizontal boring mill and clamped to the planer table. The bed plate is clamped to the circular table, and, as it only requires planing at the points *b*, *c*, *d* and *e*, the overhang of the tool is sufficient to reach across, and when one point has been planed the clamps holding *A* are loosened and it is turned one-quarter of the way around, and so on until planed at all four points.

Fig. 2 is a radius planing attachment for a shaper. It consists of a bracket attached to the side of the ram and a screw journaled in a swivel bearing in the bracket and having a nut attached to the swiveling slide of the shaper. The clamping screws are loosened just enough to allow the head to turn. JAMES F. WILLEY.

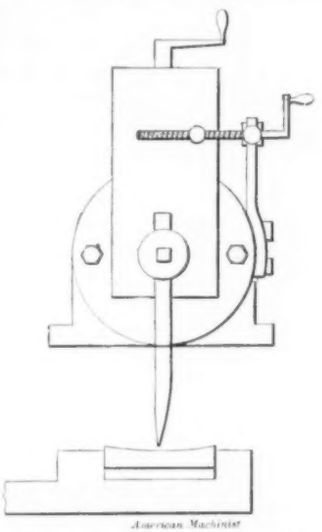


FIG. 2. SHAPER ATTACHMENT.

Cutting Small Gears.

Editor American Machinist:

I want to find a good way to cut small gears of, say, 24 pitch and 7-12 inch outside diameter. At present we put six of these gears (which are ¼ inch thick with a 5-16 inch hole) on a shoulder arbor which is as true as we can grind it, and when we take the gears off we find they do not run as true as we expect them to. If anyone can give us a pointer on cutting these gears I will be much obliged.

QUIZZER.

Turning a Big Journal.

Editor American Machinist:

Quite a number of years ago, in a small country town where I was working, was a paper mill and there was trouble with one of the machines, a rotary bleacher used for the reduction of the paper stock by steaming (cooking we might call it) to a condition in which the beating engines can more readily still further reduce the stock to that pulpy condition when the water in the paper machine can separate the fine fiber and collect it on the screen-covered cylinders from which it is removed by an endless web of felt and passing on, is partially dried and is then run off and between heated rolls until it is dry and has become paper. There, I did not intend to go so far from my subject—the "rotary." The one I made the acquaintance of was a big cylinder some 25 or 30 feet long and 8 or 10 feet in diameter, made of boiler plate and resembling a boiler, only it had no flues or firebox. Along one side were trap doors or manholes through which the stock was charged and discharged, and at either end was an immense journal about 18 or 20 inches long and nearly as many inches in diameter. These big journals rested on rolls of about 10 or 12 inches diameter. Both journals and rolls were cast iron. The rolls in turn had journals about 5 or 6 inches in diameter and length running in lignumvitæ. At one end of the big cylinder a cog wheel encircled it, in which ran a pinion, thus rotating slowly the ponderous thing. Steam was admitted through the center of the journal on this end.

My story properly relates to the journal and rolls on the end opposite the driven end. The two rolls and their lignumvitæ boxes rested in a cast-iron case, the blocks of wood being set into notches cast into the iron case for the purpose. The idea was to keep oil enough in this case to keep the lower part of the rolls flooded, but I suppose the oil had been neglected and the rolls had gotten dry, so that the bearings were worn down till the rolls touched bottom and stopped turning and flats had become worn on them, also the big journal was badly cut. It was an easy matter to remove the rolls, take them to the shop, turn them all over and remove the boxes, but the big journal could not go to the shop. We jacked the thing up to remove the rolls (case and all), then, as this rested on a stone foundation—in fact, a part of the foundation of the building—I took a large well-seasoned oak timber and cutting a V in one side of it, let the journal down into that. I then took the crosshead from our 24x24"x6' planer and, bolting it securely to this timber, had the big thing set in motion. It moved pretty slow, but in time several light cuts

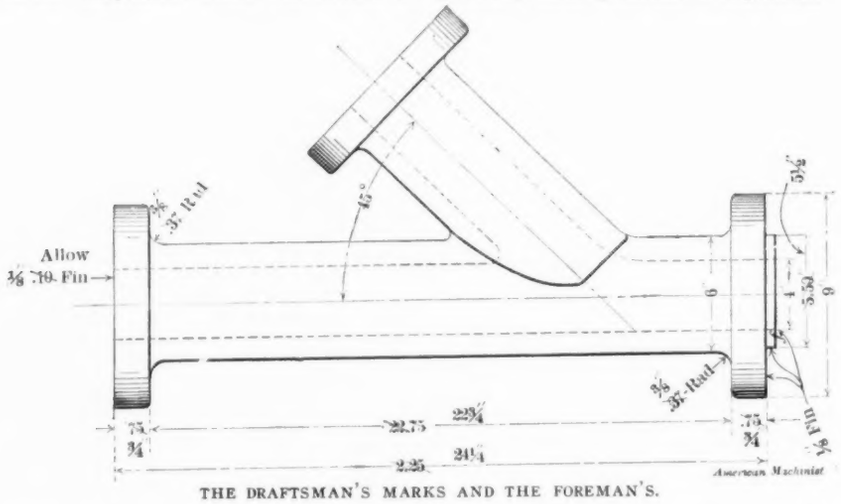
were taken across the journal as it rotated in that V, and the result was a good job. We were perhaps four days on the job. About half the time there were two of us and the rest of the time only one, with the help of all the laborers from the mill when needed. This was a dozen years ago, and, so far as I know, there was never any further trouble.

EDWARD DEHART.

Average Drawing Room Practice.

Editor American Machinist:

The sketch herewith is for a special branch pipe fitting, part of the outfit for an air compressor, which was broken in transit and necessitated a new casting. The sketch will illustrate a bad practice among draftsmen, especially young men just out of school. It also will show what a practical pattern foreman will do with a sketch of this kind before giving it to the workman, and the reason for this is that he knows from experience that the dimensions given by the draftsman will puzzle the patternmaker, and two to one he will make a mistake. As you can see in the illustration, the foreman has drawn his blue pencil through the draftsman's figures and substituted the *every-day* dimensions. The workman *may* know all about hundredths, etc., but that is not the point. Write the dimensions which are *best* understood. You will also note that the draftsman marked "*f*" on one face only, when two faces and one diameter are to be finished; note here also the practical foreman's change.



THE DRAFTSMAN'S MARKS AND THE FOREMAN'S.

The draftsman said a man must be a fool who would not understand that, but suppose the job was given to a *fool* and he finished only the face marked "*f*," what then? Would you tell him the drawing called for two faces and a diameter finished? I guess not. Make your drawings clear and help the poor son-of-a-gun all you can; you can find him in every shop.

MACHINIST.

The Shop Eye Doctor.

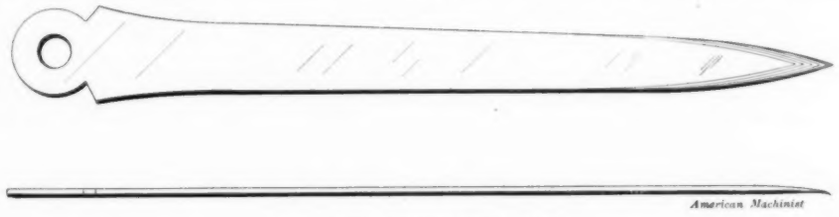
Editor American Machinist:

Several very valuable articles on the above topic have appeared in these columns, and, like many another who has done some of the eye work, both in the shop and out of it, I have read these articles with interest.

Every shop has one or more of these "doctors," so called, and as the "operations" are gratis, as friend to friend, they are not without unpleasantness sometimes; for, should you unwittingly hurt your patient, whether or no you get the offending mote out, he will want to hammer you and say "you're no good". This is so often the case where no pay is asked for professional services rendered, though g nerally much gratitude is expressed.

It goes without saying that your doctor must have a good eye, a steady hand, and some nerve; for the continued scratching by a timid, shaky hand works sad havoc on the patient's nerves, and adds to the trouble for the doctor when the case is then given to him to finish.

Sharpened sticks and penknife blades do well enough for loose, floating pieces, but are useless when the piece is imbedded in the eyeball. It then becomes necessary to cut it away from the place and lift it out, but oh! so carefully must it be done when near the sight.



EYE PICK—SHOWN FULL SIZE.

A small tool, or rather instrument, that I have used to good advantage for a number of years past is shown in the sketch. The instrument is made out of a broken Disston hacksaw blade, on account of its temper. It is about 4 inches long and 1-32 inch thick, and ground at one end to a sharp point which is magnetized. On one side of the piece the edges at the point are beveled with a fine file to a keen edge, the other side being flat. The instrument is then rubbed a few times on a hardened surface which turns upon the flat side a very fine burr that can be detected by scraping on one's thumb-nail. It is this burr that does the work so well, acting as knife and hook at the same time.

Another very handy tool is a loop of horse-hair about 1 inch long attached to a small wood or other handle. This is useful for pulling off a piece that adheres to the surface of an unsteady eyeball. To operate, raise the lid, push the loop well up and under; then close the lid, and hold while the loop is pulled down and out. This work like a charm, and is rarely felt by the patient.

Cocaine, if recklessly used, may cause more trouble than it will save pain, and is to be avoided by shop practitioners, for it may be too strong, or impure if not fresh. Eyestones and linseed are sometimes used, but their work is uncertain.

For inflamed eyes, such old remedies as Poor Richard's eye water, lukewarm water, dilute witch hazel, and a bandage of tea leaves, are all good.

A very deceptive thing is a wild eyelash—one growing near the edge of the eye-lid and rubbing on the ball of the eye each time one winks, causing annoyance and leading one to believe there is something on or in the eye. Lashes with congested roots cause a similar deception, and when pulled out show a long, stringy, black root. For these a good, strong pair of tweezers is another very necessary tool, but their points must be carefully made so as not to cut the hair.

The three tools mentioned, together with a powerful magnifying glass, complete a good shop eye doctor's kit. H. E. B.

A Machine for Beveling Steel Plates.

Editor American Machinist:

In the inclosed drawing I have tried to illustrate a machine for finishing small steel plates which were first blanked out in a punch press, and then beveled on both edges in this broaching machine. These plates were formerly milled, but the cutters, when a little dull, would make quite a burr on the job, and even when kept sharp would, at the best, turn out only about 300 per day; thus it was necessary to keep a miller going all the time, and an extra operation was required for filing the burrs. The broaching machine now turns out about 2,500 per day, and does a good deal better job.

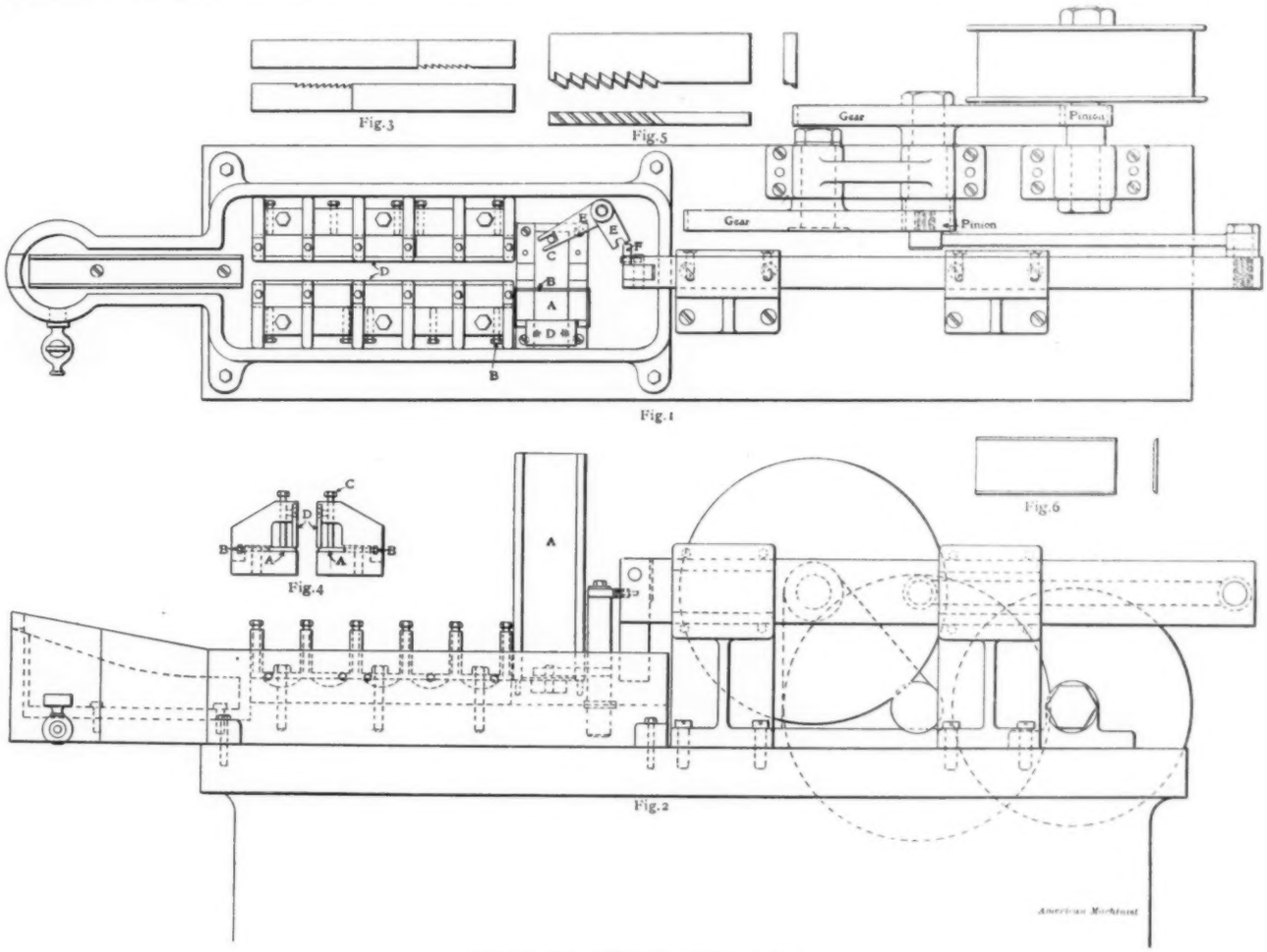
The plan of the machine is given in Fig. 1 and a side view in Fig. 2. The

mechanism for driving the work between the broaches consists of a long steel bar and gearing to which it is connected as shown in the drawing, the gears giving the bar a motion similar to that of a shaper ram. It may seem unnecesary to use the two sets of gears, but I found it took a great deal more power to drive the machine than could be obtained from the one gear and pinion as arranged at first, so another large gear and pinion were put on as shown, and these increased the driving power very much. The machine was belted up to make about five strokes per minute. When running it needs very little attention outside of the occasional brushing away of chips and keeping the hopper filled with plates.

The hopper *A* into which the blanks are put was made high enough to take about 100 plates, and the weight of these always keeps them in place to be carried into position for the broach. On the front side of the hopper is a plate *B* which has a slot in the bottom just the width of the plate to be broached, thus allowing but one blank to be fed out at a time. As the slide *C* moves back, the weight of the plates causes a blank to drop into position. A piece of steel *D*, which is fastened to the back end of the slide *C* and is just the thickness of the plates, feeds them out of the hopper, one at a time. The two levers *E* working on a stud move the slide when the pin *F* comes back in position.

Fig. 3 shows the relative positions of the broaches and guide plates when in the machine. Only one side of the blank is beveled at a time and the guide plates on either side make the tool very rigid.

Fig. 4 is an end view of the holder, showing the broaches *A*, which are adjusted to size with the screws *B*, and the top screws *C* which keep the broach down solid in the holder. The pieces *D* are held in position as shown and keep the plates down on the broaches as they pass through.



MACHINE FOR BEVELING STEEL PLATES.

The pan of the machine is filled with oil, and as the broaches are always under the surface they last a long time without being ground.

Fig. 5 is a view of a broach, showing the shape of the teeth, and Fig. 6 shows the finished plate. As the plates leave the broaches they move up an inclined way to give the oil a chance to run off and then they drop into a box on the floor.

A. H.

How One Machinist Learned One Thing.

Editor American Machinist:

I notice frequently that men are urged to learn to do some "one" thing better than anybody else. Now, that is especially good advice to young machinists. I have in my possession a pair of calipers stamped upon which are the names of all the boys who started to learn the machinist trade the same year in the same shop. There is also the figure 6 stamped upon them, representing the number of letters in the name of one boy who could not afford a stamp; we will call him "Bob." Now, we all used to have our little fun with Bob, because he spent so much of his time at the Chinese laundry. He used to say he intended to learn the Chinese language. Of course, he had to put up with having his lathe occasionally decorated with several pairs of dirty overalls, towels, etc., done to represent a laundry, together with pictures of various sorts of Chinese hung all around him, etc., but Bob just took it all good naturedly and persisted in his visits and studies until he had indeed become a very good Chinese. When he got out of his time he worked in various shops until he had saved enough for him to take an engineering course in one of the leading colleges. I saw by the daily papers a short time ago that Mr. Blank, M. E., had returned from a very successful business trip to China, where he had been sent by a wealthy syndicate to negotiate for some railway concessions. I find also that

he made more money that year than any one of the other eight whose names are on those calipers will make in the next five years, mainly through learning to do that "one" thing better than some other men. M. H. W.

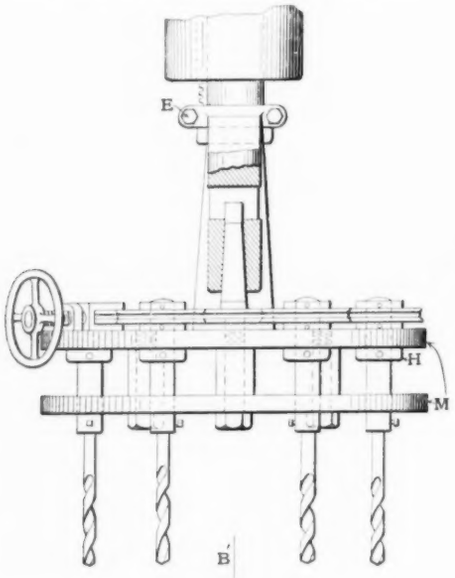
A Six-Spindle Drilling Attachment.

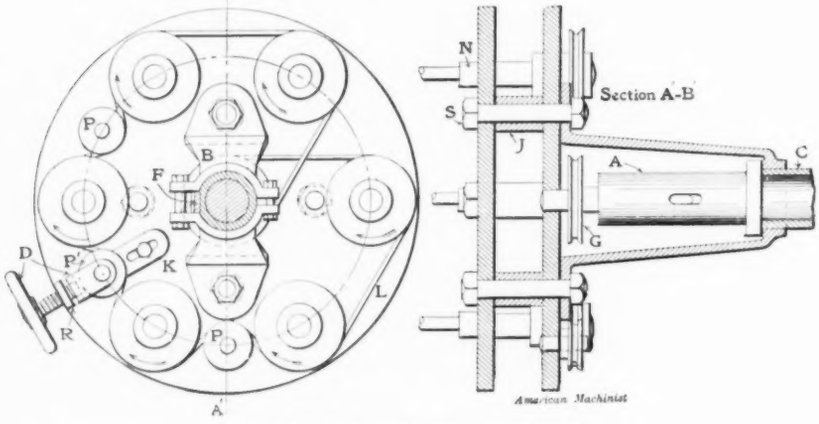
Editor American Machinist:

While visiting a small shop in the State of Connecticut, I saw a neat device for multiple drilling.

The machine is not adjustable. Its frame consists of two steel disks which are carefully drilled for bearings for the spindles *N*. Each spindle is fitted with a collar to take up the thrust, and a small sheave or grooved pulley for driving.

The sheave *G* is made with a tapered shank to fit the drill press spindle. The round belt *L* is placed about the sheaves,





SIX-SPINDLE DRILLING ATTACHMENT.

of which there are six besides the driver *G*, while the idlers *P P'* are for giving the proper surface contact.

The device *D*, for keeping the belt tight, consists of a flat piece of iron, bent as shown, for a clevis, drilled and slotted to receive the guiding bolt *K*. The screw is turned down to half its diameter on the end, to fit into a hole for keeping the clevis in its proper position. The nut *R* is fastened to the top disk by two flat-head screws.

The hanger *B* is made in halves and fitted to the rack sleeve *C* so as to use the rack *F* for a key, thereby overcoming any tendency to twist. It is clamped by the bolts *E*.

To put the apparatus into commission requires very little time, as it is only necessary to remove the nuts from bolts *E* and *S*, take off one-half of hanger *B*, and then, after placing sheave *G* into the spindle of the drill press, put on the belt and clamp hanger *B* in place.

The drills are ¼ inch diameter. The attachment is used for drilling ⅛-inch brass plates. J. N. GERMAIN.

Inside Gripping Spring Chuck.

Editor American Machinist:

The drawing shows a form of spring chuck which may be new to many of your readers, even though they are familiar with the ordinary push-out and draw-in chucks for holding rods and wires.

The present adaptation of the spring chuck principle is intended for work that has been machined on the inside and requires to have turning done on the outside.

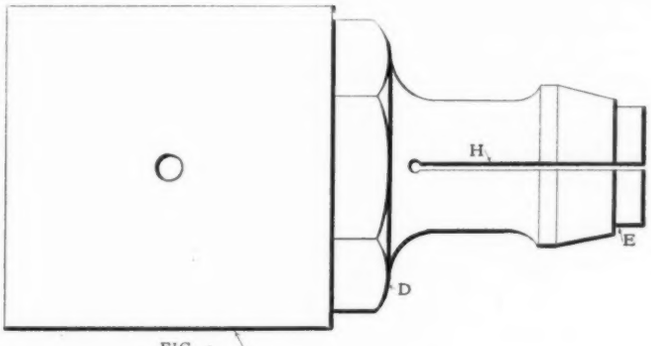


FIG. 1

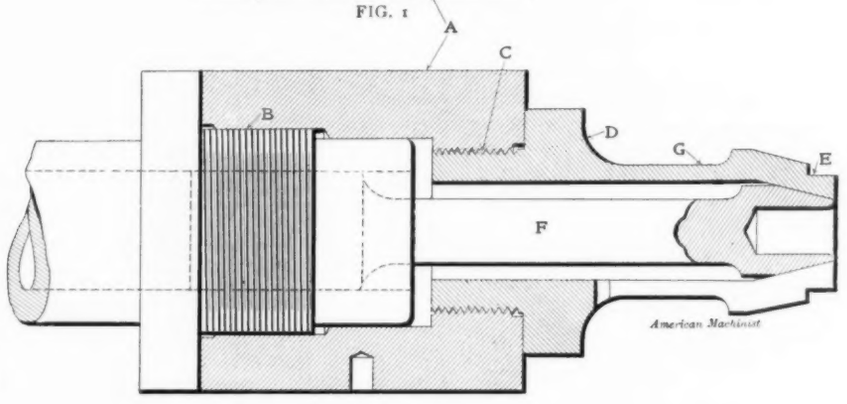


FIG. 2

SPRING CHUCK—HALF SIZE.

Fig. 1 is a side elevation and Fig. 2 a longitudinal section of the chuck. The cast-iron sleeve *A* is bored and threaded at *B* to fit the nose of the lathe or screw machine spindle, and the part *C* is threaded internally to fit the spring chuck *D*. Thus the chuck may be used on other lathes with larger or smaller spindles by making another sleeve similar to *A* to fit the particular machine. The chuck *D* has a hexagonal part by which to screw it into the sleeve, while the latter is screwed to place by a spanner wrench.

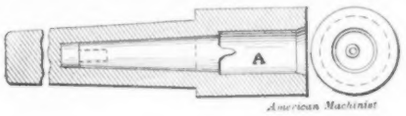
The extreme front end of the spring chuck has a seat *E* to fit the finished interior of the work, and the latter upon being placed in position on this seat is firmly held by moving the plunger *F* toward the right. The chuck has at *G* a thinner portion which is sawed through in three places, as at *H* and this gives the required spring to the chuck, which is tempered in the usual way.

This style of spring chuck, in the size here shown, will take quite a heavy cut and yet run very true, and not allow the work to slip on the seat. C. D. KING.

Punch for Centering Small Spindles.

Editor American Machinist:

The sketch shows a punch with which I have experimented and which I find works very well where there are a number of spindles of the same size to center. The hole



PUNCH FOR CENTERING SMALL SPINDLES.

A is made the same size as the average of the spindles before the stock is removed. The spindle is heated to the heat used for welding, and the tool is driven over the work with a hammer and then dipped in water for the next spindle. In the shop where I work, about forty spindles an hour are centered by a drill and 200 can be centered this way. This may not be new to all, but will probably be new to some.

B. O. BUTLER.

Jig for Facing a Gear Bracket.

Editor American Machinist.

Fig. 1 shows a gear bracket, and Fig. 2 a jig and tool for facing off the end of the collar *B*. *A* is a stud for carrying a bevel gear, and is made taper and chilled, and the soft cast-iron collar *B*, which is cast in the end, must be faced to the proper length to bring the gear in the correct position.

The hole *C* is bored and reamed in a drill

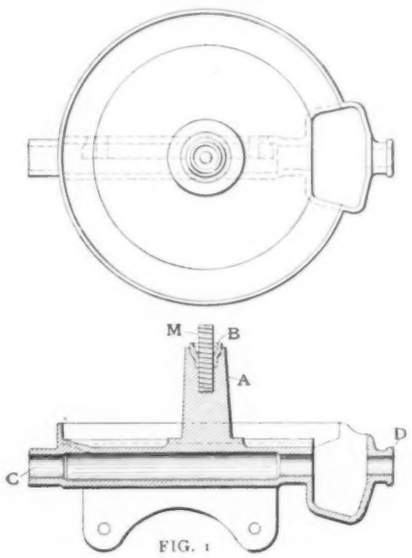


FIG. 1

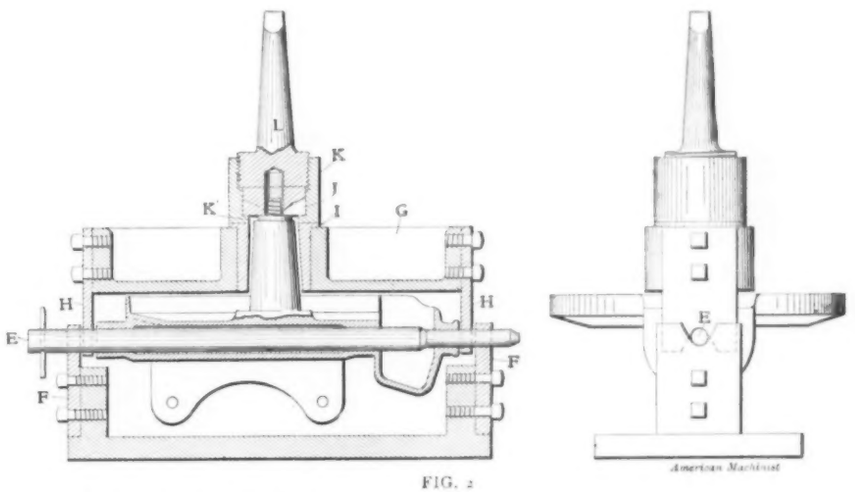


FIG. 2

FACING A GEAR BRACKET.

press, the end of the sleeve *D* resting in a hollow center. The rod *E* is then slipped through the hole and placed upon the steel V-blocks *F*, as shown in Fig. 2.

The upper part of the jig consists of a casting *G* with steel V-blocks *H* fastened to the ends, and has a hardened tool steel bushing *I* large enough to slip over the stud *A*.

The facing tool consists of a cutter *J* which fits into the hardened tool steel sleeve *K*, and is held in place by the shank *L* which screws into the upper end of *K*.

When the upper part of the jig is placed over *A* with the V-blocks resting on the rod *E* the facing tool is fed down with the drill press lever until the lower end of *K* strikes the bushing *I*, the collar *B* thus being faced to the correct dimension from the center of the hole *C*.

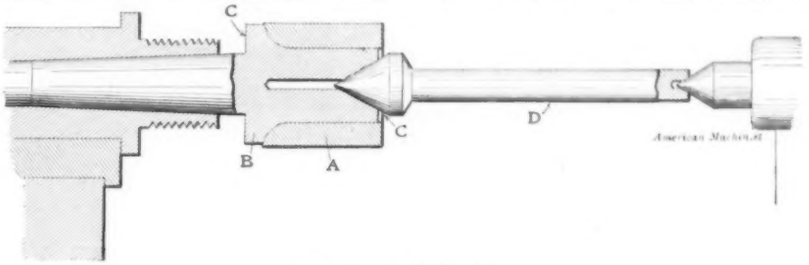
The chill and core for holding the collar *B* and the stud *M* in the mold are quite complicated, and I will describe them in another letter.

J. P. APPLEBY.

Expanding Mandrel.

Editor American Machinist:

The accompanying sketch shows an expanding mandrel for turning and facing



EXPANDING MANDREL.

the cast-iron rollers shown at *A*. The mandrel *B* has a taper shank to fit the lathe spindle, and a shoulder *c* to take the thrust of the tool while facing the other end of the roller.

A deep center is put in the outer end of the mandrel at *C*, to take the loose center *D*; the mandrel is then split in three places as far back as the shoulder *c*. The work is slipped on over the end of the mandrel and the loose center then put in place and forced up by the tail center screw, the taper on *D* expanding the mandrel enough to hold the roller while facing and turning.

The large center on *D* has enough bearing surface, so that *D* will always turn on the dead center; and a little castor oil or white lead can be used on this center to prevent heating. The hole through *A* has been bored and reamed by a previous operation.

It is not necessary to stop the lathe to put in or remove the rollers from the mandrel; a couple of turns of the tailstock will allow *D* to be removed, when the work can be slipped off the mandrel.

J. P. APPLEBY.

Some Machinist's Tricks.

Editor American Machinist:

Not long ago I saw one of the curious tricks of the lazy man. He had a job of boring several sleeves about 18 inches in length to a bore of 3 inches, boring from the solid. Having secured the drill and bringing up the tailstock to force the drill into the metal, I was surprised to see him fish a chain from beneath the lathe and instead of clamping the tailstock, as is usually done, he just took the chain and linked it around the carriage and tailstock. Starting up the machine and throwing in the carriage feed, the lathe did the work while he sat down and rested, now and then releasing the feed to clean the chips from the job and see if the drill was sharp enough to stand the cut. Now what I would like to know is whether the tailstock is made to be used for drilling by being hooked to the carriage or by using the hand wheel.

Another case of bad practice in the same shop: One of the men was given several brass sleeves to bore, the sleeves having flanges about 3 inches from their ends, the diameter of the flanges being about 8 inches and the sleeves about 4 inches outside, with the hole cored to be bored and threaded for 1¼-inch gas pipe. Before boring he faced the flanges without using either a support or bringing up the tailstock to steady the work. Everything went along smoothly until he faced off the flange on the last sleeve (the sleeves were 16 inches long), when his tool dug in and the consequence was a broken compound tool-rest. When asked by the foreman how it happened, he said he could not explain it, as he had done all the others the same way. Just a little "tiredness" in not using his tailstock, some of us thought.

The 28-inch lathe got out of repair. When going to chase threads the screw gearing being independent from the feed screw, the feed mechanism would lock. Being reported to the foreman in charge, he and the man running the lathe made an examination and found that the lead screw was worn too much at a certain point from chasing short threads. A new lead screw being made did not help the trouble any. One of the men suggested that the gearing be overhauled and repaired. He was asked whether he was running things around there, or who? When they chase threads nowadays they remove the rack, so they do not have any trouble. They have been removing the rack for three months or more now, and they chase threads every day; can't find the trouble. FAULTS.

Eye-Glass Strap Dies.

Editor American Machinist:

The drawing submitted shows in detail the dies used for manufacturing the straps familiar to all who wear eye-glasses.

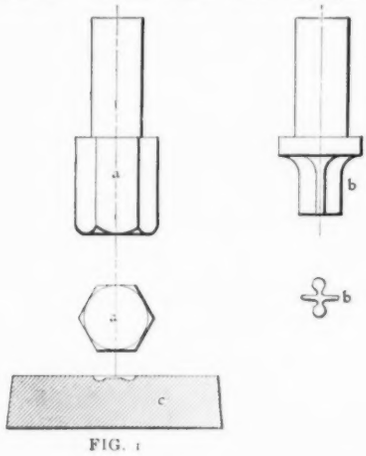


FIG. 1

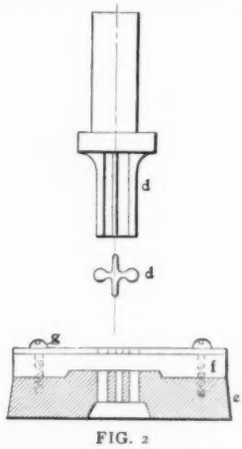


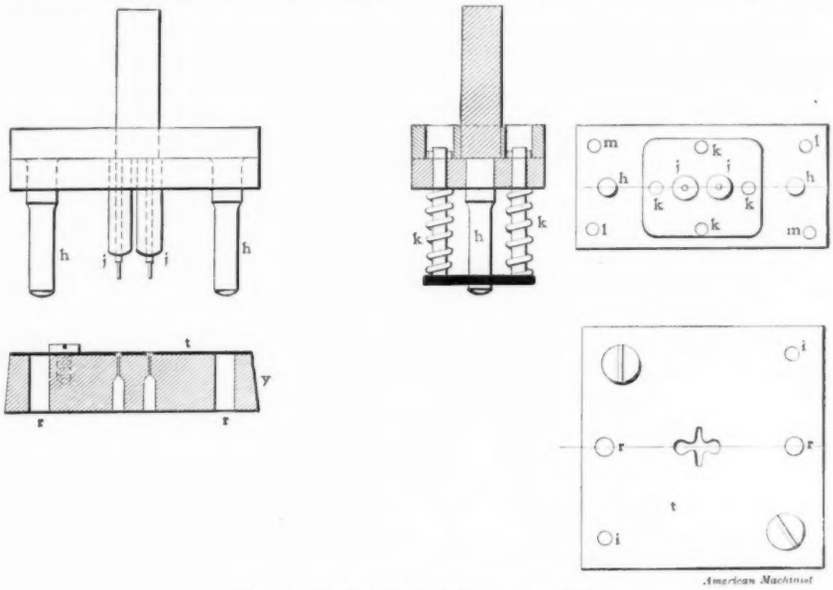
FIG. 2

American Machinist

BLANKING AND EMBOSSING PUNCHES AND DIES.

There are, of course, many styles of straps, varying with the different firms; in general appearance, however, they all resemble each other more or less. The strap shown is considered to be one of the best, owing to the fact that the threaded portion is reinforced, as will be seen by the cross-section in Fig. 5. To produce the strap four operations are necessary, these being performed in the blanking die, Fig. 2; the embossing die, Fig. 1; the perforating die, Fig. 3, and the bending die, Fig. 4. The main condition was that the strap, being made of gold, should not exceed a given weight. Furthermore, every portion of the strap must be touched in the embossing die, thus giving it a smooth surface, and all the dimensions of the different parts must be within 0.001 inch.

As customary with this class of work, the embossing die was made first. Two samples were filed from a strip of soft German silver. One of these was finished completely as shown at *A*, Fig. 5, and screwed to a lens, while the other one, at *B*, was soldered to the face of the hob. This hob, shown at *b*, Fig. 1, was used to strike the impression into the embossing die *C*. The hob was roughed out in the milling machine and afterwards filed to the exact shape of the sample soldered to its face. In making a hob of this kind care should be taken to have it as short as possible, so that it will not bend while striking up the embossing die. All the punches used with the various dies were turned from octagon tool steel, 1 inch in diameter, and two punches were always turned together. The embossing die was then planed down, care being taken to have it quite a loose fit in the die bed. To strike up the impression, we proceed as follows: The die is put in the bed cold and the hob inserted in the punch holder of the power press. The die bed is then clamped down and the ram of the press brought down by hand until the hob is a little above the spot in the die where the impression is desired. Now the die is slipped out and the ram lowered until the hob shows a sufficient depth in the die which is pushed up against it sideways. The ram is raised to its full hight with jam nuts loose and the adjusting bar left in the adjusting nut. The die is then taken out and heated. I have found it to be good practice to clamp another die alongside of the one to be struck up, to form a gage, as it were, for the heated die. It is unnecessary to state that no time can be lost in gaging the die while hot. A chalk mark or any other kind of a mark will hardly do, as it is sometimes necessary to strike twice, and, if not properly secured, the die is liable to shift. It is not advisable to clamp the hot die with the set-screws of the die bed, as this method invariably leaves a bad mark in the die, and in most cases the screws are not in a good turning condition. When the die is hot enough, it is picked up with the tongs and carried to the press at a little livelier gait than that of messenger boys and slipped into the die bed. The flywheel of the press is then turned by hand and the ram brought down. If the impression should not be deep enough, the adjusting bar left in the ram can be operated rapidly and a



American Machinist

FIG. 3. PERFORATING PUNCH AND DIE.

second stroke will bring about the desired result.

As soon as the die has cooled off sufficiently, it is taken to the shaper and several very light cuts are taken off. This is done to bring the corners of the impression, which have been drawn inward by the striking-up process, level with the rest of the die. We now proceed to finish the impression. In order to obtain greater symmetry of the spherical portions, we make two end mills of Stubs steel, filing the ends to the desired shape, and putting teeth into them by means of a three-cornered file. These end mills also assist in giving the spherical portions the proper diameter. The impression is then scraped and polished to a high finish. The embossing punch is made next and hardened glass hard. In ordinary practice we would now harden the die, but in this case a different plan was followed.

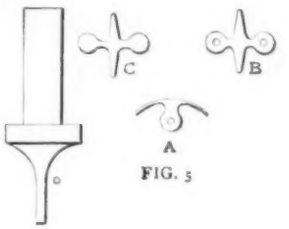


FIG. 5

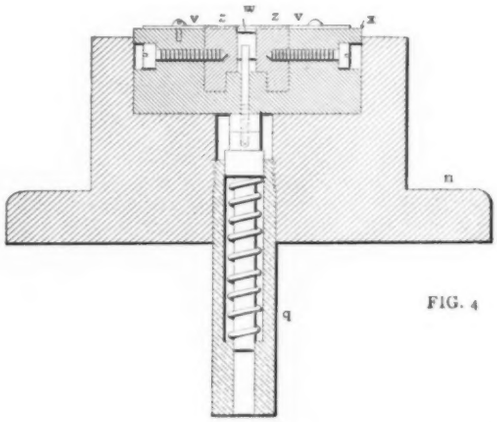
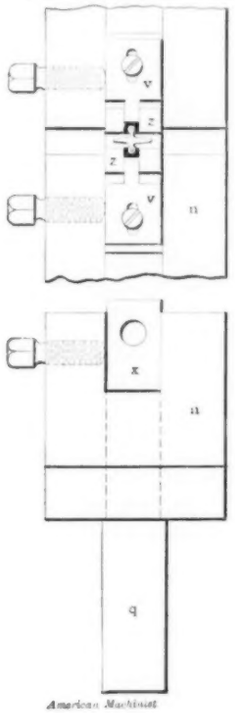


FIG. 4



BENDING PUNCH AND DIE.

It has been stated before that one of the spherical portions is heavier than the other, although both are of the same diameter. This would make it essential that one of the round sides in the blanks be larger in diameter than the other, and to get the various dimensions a little experimenting is necessary. To try the embossing die a thin strip of lead is used until a p rfect strap is produced. The die is then hardened as hard as fire and water will leave it. A little yellow soap rubb d into the impression before heating will cause it to come out of the bath very hard and bright around that spot.

The blanking die is made next. Two samples are filed to size approximately. One of these is tried in the embossing die and struck up. Any defect can be corrected in the other one, and a third sample, or master blank, like the corrected one is made. No. 2 sample is then tried in the embossing die and any corrections necessary are made on No. 3. This method is continued until a perfect sample is obtained. *C*, in Fig. 5, shows the correct article, which is soldered to the face of the punch after the die *e*, Fig. 2, has been made accordingly. Both gold and German silver are used in the production of the straps, and as these metals are very hard on delicate-edged dies they are filed almost straight all the way through. The face of the die is relieved, as shown in the drawing, so that it is not necessary to grind the entire surface of the die. The gage is shown at *f*, while *g* is the sheet steel stripper.

Fig. 3 shows the punch and die used for perforating the strap as at *B*, Fig. 5. A correct sample is drilled and the holes are spotted off on die *y*. These holes are also marked on the back of the die and drilled, with a larger drill, a little more than halfway through, as shown in the section in Fig. 3. They are then drilled with a drill several thousandths smaller than the desired size and finished from the back with a taper reamer. Small reamers of this kind can be made from Stubs steel, filed taper and then square. The gage-plate *t*, of sheet steel, is made as follows: After it has been filed square it is clamped to the die and the holes for the screws are drilled from the back of the die. The clamp is now taken off and the holes for the dowel pins *i i* are drilled in the same manner. The dowel pins are riveted in place, the plate is screwed to the die and the perforating holes are drilled through the back of the die into the gage plate. This is then taken off and the holes are enlarged to the proper size. Before doing this, however, the outline of the strap is scribed off on the plate after inserting two drills or pins through the sample into gage-plate and die. The shape of the strap is now filed out, and if these operations are gone through carefully as described, the perforations will be in the center of the strap. When it becomes necessary to grind the die or to remove any dirt or small chips from the gage-plate, the latter may be taken off and put back again without fear of disturbing the alinement. Fig. 3 shows the punch in three different views. At the left hand it is without the stripper device. The section shows the stripper at rest, while at the right hand punch and stripper are shown in plan. Two stout guide-pins *h h* slide in the die at *r r* when in operation. The perforating punches fit snugly in the Stubs steel punch-holders and are riveted over and inserted from the back. The two parts of the punch-holder body are held together by screws *l l* and dowel pins *m m*. The holes for guide-pins *h h*, as well as for punch-holders *j j*, are spotted off through the back of the die, the lower plate of the body being clamped to the face of the die *y*. This perforating die operates in the following manner: An embossed blanking is placed in the opening of the gage-plate, and as the punch descends the guide-pins *h h* enter the die until the stripper plate strikes the gage. The four springs *k k k k* now compress and their respective guide rods slide up through the holes in the upper part of the punch-holder body. During the upward movement of the punch the springs open again, thus stripping the blank from the punches.

Fig. 4 shows the tools for the last and bending operation. The cast-iron die bed *n* is slotted lengthwise to receive the snug-fitting die body *x* of mild steel. Into this die body are fitted the hardened jaws *z z*, as well as the hardened former *w* with its pin and jam nuts resting on the plunger in *g*. The jaws *z z* are slotted to the width of the spherical portions of the embossed strap and thus gage the blank sideways, while the tongued gage-plates *v v*, being adjustable, gage it lengthwise. The construction of this die should be plain from the drawing. To bend the strap, it is placed in the groove in the jaws *z z*, the spherical parts only being held. With the down stroke the forming punch *o* bends the strap inward until it rests on the female former *w*. This moves down until it strikes home and the strap is bent in the shape at *A*, Fig. 5. At the same time the pin in *w*, or, rather, the jam nuts at the end of it, compress the spring around the plunger in the brass holder *g*. On the up stroke of the punch *o* the female former, being forced upward by the compressed plunger spring, keeps the strap on the punch, where it is stripped off with the fingers. The brass holder *g* is screwed into the die bed *n* until the female former almost touches the strap lying at rest in

the gage. It is well to anneal the punchings after the embossing operation, as the sharp corners of the punch *o* are liable to break them. This reinforced style of eyeglass straps is patented.

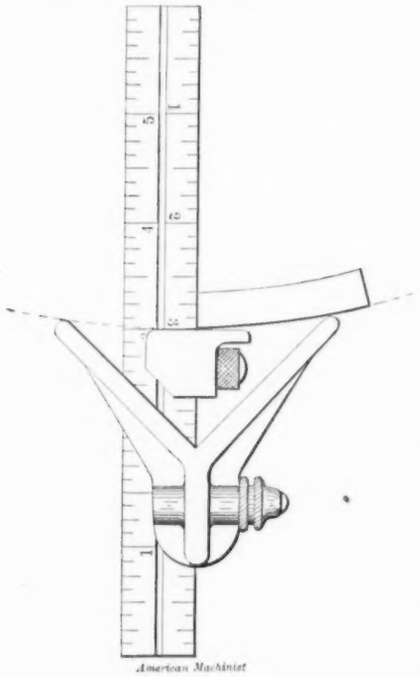
FRANK GREINER.

Gaging the Ends of Segments.

Editor American Machinist:

Some time since, having a variety of sizes and shapes of thin conical rings averaging 18 inches diameter by 3 inches wide, to cut into segments about 4 inches long, the ends to be afterward milled so the joints would fit fairly together interchangeably when the several pieces were again placed to form a ring, it was thought that some device which could be easily adjusted to give an idea of the correct angle would be handy, and the following one was made for an experiment:

Near the center of length of the 6-inch



SEGMENT GAGE.

blade of a Starrett combination square, a block about 1 inch long was soldered so that it was square across the blade, and its center of length at the edge of the square blade substantially as in the sketch (which shows the new construction). The blade thus fixed and used in connection with the regular center head was found very convenient and led to the improved construction as shown, in which the block is about the same thickness as the center head, and is clamped to the blade with bolts and nuts, as is the center head itself.

The only thing to be looked out for in making this attachment is to be sure that the center head will make its scale lie coincident with a line at a right angle to a straight-edge against which it may be placed, and, also, that the block is of equal length each way from the working edge of scale and square across.

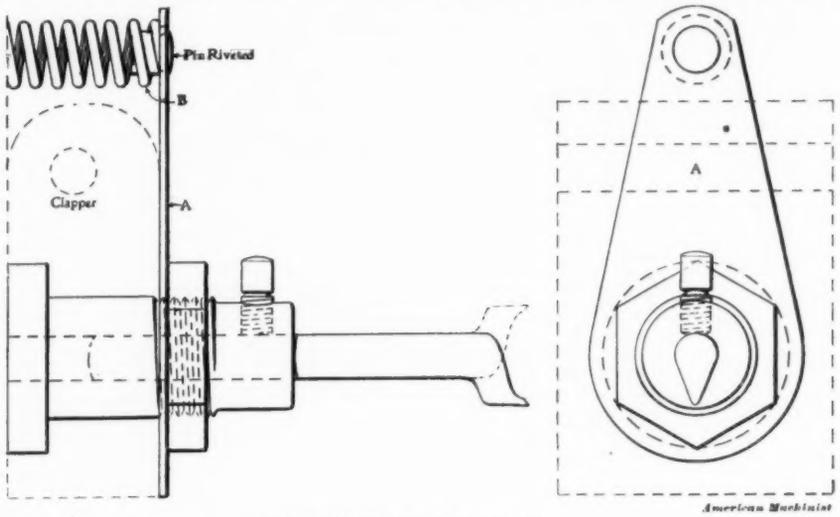
To adjust for use on any circle it is only necessary to bring the block and both arms of the center head into contact with the circle and clamp firmly; the tool may then be used as an ordinary try square across the ends of pieces of the same circle it was adjusted to.

C. S. BEACH.

Tool Holder for the Shaper.

Editor American Machinist:

Enclosed please find a drawing of a tool-holder to go in place of the usual



TOOL HOLDER FOR THE SHAPER.

tool post on a shaper. This tool holder and tool will be found very convenient in shaping the top, sides and bottom of square and similar holes in dies, shoes, etc.

The clapper is indicated by dotted lines. By loosening the hexagon nut the tool can be swung around into cutting position for the four faces. Plate *A* and spiral spring *B* hold the clapper down in position.

Thinking this form of holder has never been in print, I therefore submit it to your approval.

X. N. TRIC.

A Milling Machine Job.

Editor American Machinist:

Fig. 1 shows a turned piece, ½ inch in

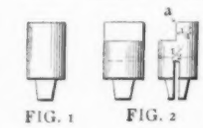


FIG. 1 FIG. 2

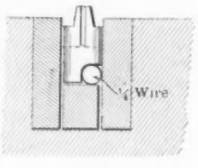


FIG. 5

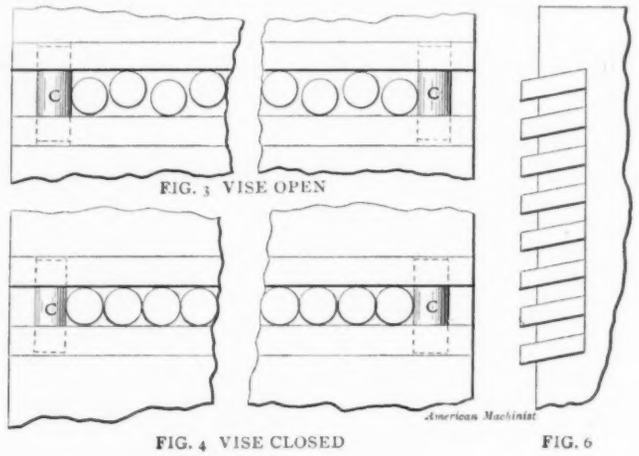


FIG. 3 VISE OPEN

FIG. 4 VISE CLOSED

FIG. 6

A MILLING JOB.

diameter, to be milled as in Fig. 2, and Figs. 3 and 3 show the vise jaws as arranged for the work, two pairs of holes, say, 7-16 inch, being drilled in the ends of the mild steel jaws and made a working fit for two Stubs steel pins *C*. To do the milling operation at *a*, Fig. 2, the vise is opened a little more than the thickness of the pieces to be milled and as many pieces put in as will fill the space between the two steel pins when the tightening of the vise has put them in line, as in Fig. 4. The distance between the pins is an exact multiple of the diameter of the pieces, or a little more, so that shims can be used. The tightening of the vise will force the pieces in a normal position and hold them there, because in any other position they would require more space between the pins. To cut the slots in line with the first milling a piece of ¼-inch wire is used, as in Fig. 5.

I believe this idea came from reading an article in the AMERICAN MACHINIST some time ago about the collapsing of a broaching tool put together as in Fig. 6.

J. SCHURING.

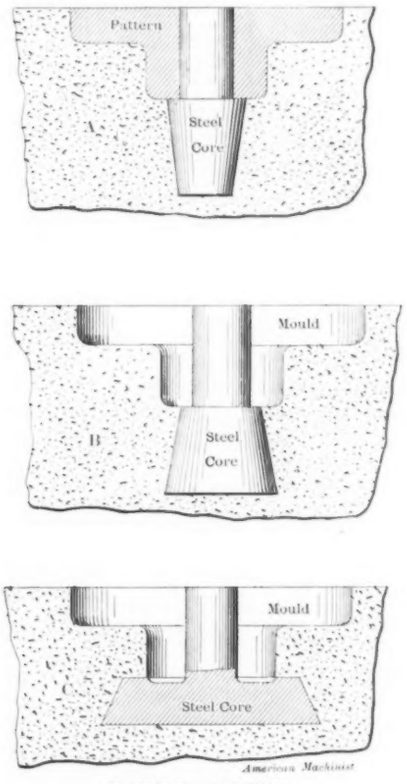
Micrometrical Precision in Casting Iron.

Editor American Machinist:

The firm with which I was connected some years ago made a specialty of several cheap machines. Other makers of these machines were in competition with us, and as we had introduced some rather

expensive improvements to make a bigger show in the market, it was necessary to cut down cost of manufacture. Without impairing the quality of the machine this was impossible unless some radical change could be made in the castings to do away with unnecessary fitting. While on this job we proved that simply by the use of dry-sand cores carefully made, with good material perfect fits could be obtained—in fact, much better than was possible by rough machining.

Great care was taken in making the patterns an' core boxes, all patterns when possible being fitted on to plates and the core boxes being made solid—that is, without joints, and simply drawn from the cores. To insure that the cores were fixed correctly in the molds, they were placed in the patterns and rammed up with them.



PRECISION CASTING.

the patterns being withdrawn and leaving the cores in the mold. Certain of the castings were fitted on to square shafts, others on round shafts, but no difficulty whatever was experienced in making a good job. In the case of the round holes, these were reamed with a square reamer to remove the sand, and finished with a cheap English fine-fluted reamer. We made a point of pouring the metal at as low a temperature as possible to avoid "eating" into the sand.

The cores were made simply of Mansfield sand, a sand of very fine texture used for bench work in foundries here, and were well vented. No binding material whatever was used, as this sand when dry makes a core "as hard as nails." After drying, the cores were dipped into thinly mixed blacking (plumbago) and again dried, this process being repeated several times. I never actually measured the result, but should say from experience that the variation would not exceed 1-1000 inch, and this is near enough for rough work, and perhaps as near as some of the fine (?) work is turned out.

A point which strikes me in relation to the job referred to at page 1263, by Lucien I. Yeomans, is why not have rammed up the steel core in the mold fixed in position in the pattern as described above in the case of sand cores? (See sketch *A*.) To prevent any possibility of the core being drawn by the pattern it could be tapered the opposite way, as shown at *B*. Also, by making the core as shown in *C*, the boss could, if necessary, be cast true with the hole.

FRANCIS W. SHAW.

Birmingham, England.

Overcrowding Machines.

Editor American Machinist:

Long experience as a workman and foreman has taught me a few lessons that I will never forget, and this "positive milling machine arbor drive" comes in very nicely under one of these lessons. I have made a mistake, and I venture to say others have. It is this:

Men take charge of a shop and before taking time and giving the work in detail proper consideration they undertake to make changes and to crowd the machinery almost beyond its capacity so as to make a good showing for their department. This is all well enough if it can be done.

Not long ago I was called to a car shop by the foreman to look at a bolt header. This foreman was not a mechanic, but he had a few good ideas. He also had a patent on a car appliance, and on account of this he got his position as foreman.

"What's the trouble, Brown?" said I.

"Well, I'll tell you. A salesman called on me not long ago and he said: 'Brown you use a large number of bolts, don't you? Why don't you make them yourself? I can put you on to a good bolt header that can be bought for a song.' I bought the machine, and just look at it; the frame is split in two in the middle."

"How did you do that, Brown?" said I.

"Well, I started to head a lot of small bolts and it worked all right. Then I had a lot of large bolts to head, and every little while that damn plate would break (referring to the safety plate in the machine), so I just stuck a chunk of steel in there, and you bet it did not bother me any more. Now the frame is cracked; it's a wonder to me why those fellows who build machines would not make them strong enough."

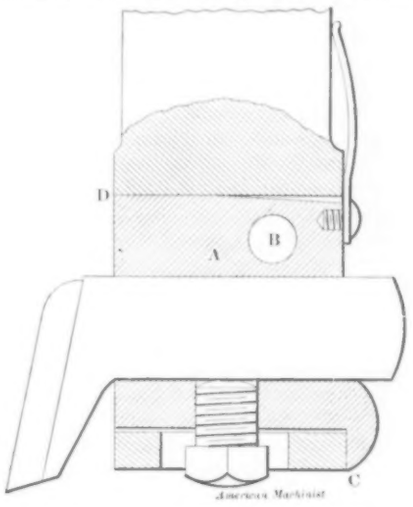
This foreman was trying to make a machine head 1⅛-inch bolts that was limited to ½ inch. Don't ask too much from your milling machine, or you might crack one of the oil cups.

FOREMAN.

The Tool Holder for the Slotter.

Editor American Machinist:

At page 1275 I notice a communication on tool-holders for the slotter by Mr. Frank Rattek. I think his idea is correct regarding this tool. I enclose a sketch of a slotting tool-holder which I made twenty-six years ago. The post is slotted through for the reception of the block *A*, which is secured by a taper steel pin *B*. The block



A TOOL HOLDER FOR THE SLOTTER.

extends on the back to the bottom of the post at *C* where it has contact. Contact is also made at *D* to take the strain off the pin while doing heavy work. The bottom of the post is counterbored for a box wrench for the set-screw to secure the tool. A spring at the back keeps the tool up to its work. Another modification of this tool is to have the tumbling block slotted at an angle of 10 degrees, using straight stock, the cutting tools in this case requiring no forging.

Dundas, Ontario. JOHN BERTRAM

Reboring a Pulley.

Editor American Machinist:

One day the manager of the brick yard came into our shop and asked if we could bore out a big pulley for him. It was one they used to have on a 3-inch shaft, but they had not been using it for some time and now wanted to put it into service again on a 3¼-inch shaft. It was a solid cast pulley, about 60 inches in diameter and 12 or 14-inch face. The hub was, I think, about 10 inches long, though it might not have been more than 8, which, however, does not matter now. What he wanted was to get that big pulley bored out to go on a larger shaft than it was intended for when made, and I don't believe he thought we could do it when he asked, for he well knew that there was neither lathe nor boring mill in our small town that would swing 60 inches. But he did want to avoid sending that pulley fifty miles by rail, paying freight both ways, so he asked if we could bore it, and then was not inclined to think us in earnest when we told him we could

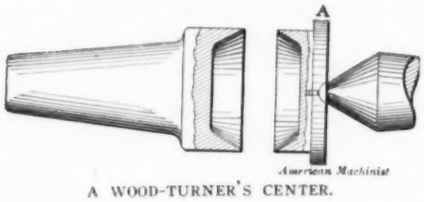
"Bring it right up," said I, "and by this time to-morrow it shall be ready for you." He said he would have the pulley sent right up, so I started at once to get ready for the job. We had odds and ends of shafting in the shop, so, taking a piece of 3¼-inch shafting, about 2½ or 3 feet long, I turned one end for about 6 or 8 inches, allowing for a finishing cut when the pulley should arrive so as to form a pilot nicely fitting the old bore. At the shoulder formed by turning I drilled a hole and inserted a boring tool the end of which was just flush with the large diameter, and the cutting edge of which was about 1-32 inch in advance of the shoulder, thus regulating the amount of feed. I splined from the end of the shaft up to the tool to allow the chips to drop down, then when the end was turned to fit nicely in the bore of the pulley, which by that time had arrived, we were ready for business. And I might add right here, for the consolation of some of my fellow job shop operators, that the work yet to be done on that pulley was about the only part of the job that many of our customers could have distinguished as belonging to them. That was all right in this case, as they neither saw the tool made nor the pulley bored, and I do not now remember whether they knew how the job was done or not.

I think by this time the reader knows just about how the job was done, but to complete my story I will go on. With the pulley laid flat and blocked up about a foot from the floor, with the bar inserted and a dog put on the upper end, between the tail of which and the shaft a piece of 1½-inch gas pipe, long enough to extend well across the pulley was laid, two men walking round and round the pulley easily and accurately bored out the hole, or counterbored it, if that would be more correct. The bar being pretty heavy furnished all the weight or pressure needed to feed it into the work. While others may suggest other ways, still I think this method of reboring a pulley is about as simple and cheap as any, especially as you can employ the very cheapest of labor to do the boring. EDWARD DE HART.

A Wood-Turner's Center.

Editor American Machinist:

"Patternmaker's" kink at page 1281 reminds me of a center I made some years ago, as shown in the enclosed sketch. The



A WOOD-TURNER'S CENTER.

center is particularly useful for split work. To locate the two parts, simply scribe around the center points two circles equal in diameter to the center and the friction plate. The shape of the dished portion tends to draw the joint closer. The flange *A* is to enable the plate to be "levered" out of the work. COSMOPOLITAN.

Driving Milling Machine Arbors.

Editor American Machinist:

The articles that have appeared in the columns of the AMERICAN MACHINIST recently on this subject have been very interesting, as the driving of milling arbors is becoming quite a problem. A few years ago, when manufacturing was not so strenuous, the flat tang that is so common filled all requirements; but now, to be up to date, we must have something better, especially when we come to use the all-gear feed that is being introduced by the leading milling-machine builders.

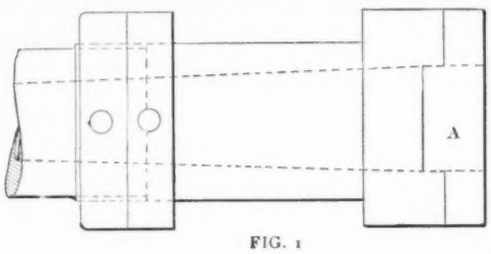
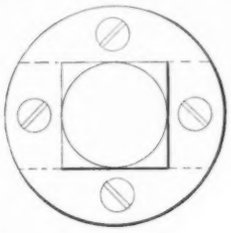


FIG. 1



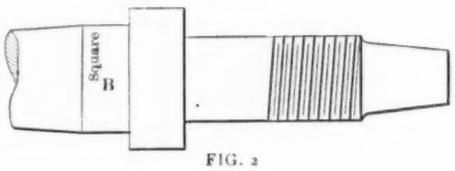


FIG. 2

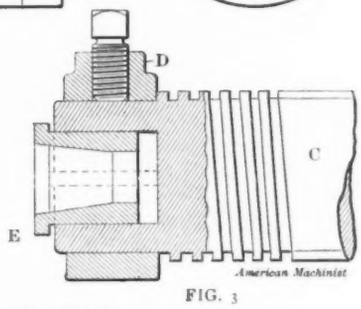


FIG. 3

DRIVING MILLING MACHINE ARBORS.

Mr. Ridderhof's description at page 1120 of his method leads me to present one that I adopted after having a number of tangs twisted off. I applied it to a Lincoln miller, and as there was no thread on the end of the spindle I planed a slot across the end the width of the hole and ¼ inch deep, as shown at Fig. 1. I then fitted the piece *A* of tool steel and secured it with four screws. Through this piece is a square hole of the same dimensions as this slot. This makes a very positive drive, as into this is fitted the arbor which is made square at *B*, Fig. 2.

To use the arbors in stock, it was necessary in some cases to refit them in order to let them back into the spindle far enough to make a square about ½ inch long. By fitting the arbor into the spindle nicely and having both free from oil, I have no trouble with the arbors coming out when driven in good and solid. I still use the tangs for driving out.

I have had a great deal of trouble with the other ends also of the arbors until I changed them as shown in Fig. 3. *C* is the tailstock spindle found with this type of machine of some makes, which is usually split and bored out and into which is fitted the arbor. Both are hardened and on the end is the collar *D* with a set-screw which is used to take up wear and overcome any variations in the sizes of the arbors. The change I made consisted in boring out larger and fitting in a bushing *E*, which I bored out tapering about 2 inches to the foot. The size of the hole was a little smaller than the ends of the arbors, so that I could fit them by grinding without annealing.

When setting up the machine I do not clamp the bushing very tight and do not put it in all the way to the shoulder, but leave it out about 1-16 inch, so that if there should be any expansion to the arbor the bushing can push back into the spindle and neither the arbor nor the bushing will be injured by heating. With this arrangement I am able to always keep the arbor rigid and still it will run free. I have been using this for over three years, and the arbors and bushings are still in excellent condition. A. MILLER.

Cutting Off Rubber Rolls.

Editor American Machinist:

I had a number of small rubber rolls to cut from old 1¼-inch tires and I had great trouble cutting them to proper

JIG FOR SAWING OFF RUBBER ROLLS.

length and getting the ends square. I made a jig of hard wood as in the sketch, and cut them on the bandsaw, and after that I had no trouble. The cross lines on the face of the jig are saw cuts. The rubber rolls were used on special machines built where I was employed.

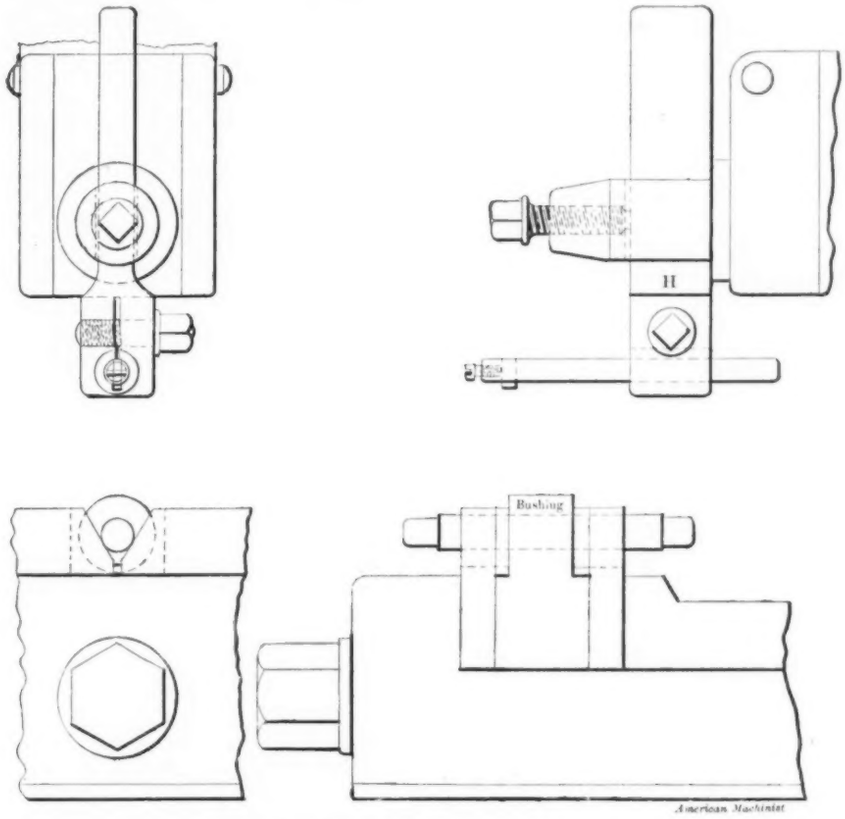
MACHINIST.

Cutting Keyways in Small Collars.

Editor American Machinist:

A convenient arrangement for cutting keyways in small collars, gears, handwheels, etc., is illustrated by the accompanying sketches which show a small collar

in the shaper vise in position to be operated upon, and the tool used. The V in the jaws serves the double purpose of permitting a good grip to be had on the collar and affording a ready means of locating any number of pieces exactly the same in



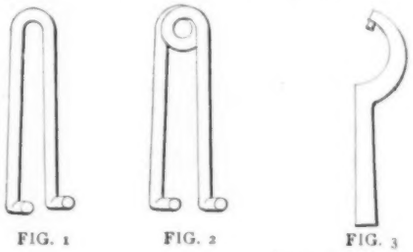
CUTTING KEYWAYS IN SMALL COLLARS.

the vise. In use, put a shaft or mandrel in the hole in the piece to be splined, rest the shaft in the V's, tighten the vise, remove the shaft and proceed with the cutting. Subsequent pieces will be located the same, making it necessary to set the tool but once. The construction of the tool makes it easily adapted for short or long work, and does away with the forging of many tools. Holder *H* has a hole for the largest bar and bushings adapt it for holding smaller sizes. W. R. G.

Machine Wrenches.

Editor American Machinist:

I note with pleasure the article by S. P. Y., at page 1422, dealing with machine wrenches, but I wish he had gone more into detail and shown where and how the number of wrenches could have been reduced. It seems to me that we are drifting toward a point where it only will be necessary to buy the wrenches and the machine will be thrown in as a necessary evil, for the up-to-date machine tools are afflicted with the wrench disease more than machines of older make. The fault seems to-day with the designers, who hold fast to theory and cater to appearance in the designing of details; but I believe them to be too intelligent not to remedy the trouble after it is pointed out to them by the practical man at the machine. Now, I have a case similar to S. P. Y.'s key-seater, right here in the toolroom, in the shape of an up-to-date universal grinder which requires eleven wrenches, including two double-enders, for the different operations. The screw-driver was omitted, probably for the reason that some of the oil holes are closed with slotted-head screws and all the dogs for cylindrical grinding also have slotted-head screws. On top of this it takes three sizes of wrenches to perform the operation of fastening fixtures to the work table. The grinder is supplied with a small shelf for the wrenches, on which they form a nice little heap, and when the grinder is in operation, two or more always keep company on the floor. In reducing the number



MACHINE WRENCHES.

of wrenches on this machine I will start with the hexagon nuts, there being three sizes, ⅞, 1 and 1¼ inches, and by making them all 1 inch I will do away with one double-end wrench. There are two sizes of square-headed screws, ⅜ and ½ inch, and these just as well could be ½ inch. Two sizes of spanner wrenches like Fig. 1 could be made into one by making an extra coil at the end (see Fig. 2) so as to give enough spring to allow the wrench to close up for the smaller sizes. The same wrench could be used in place of wrench Fig. 3, it being much better than the latter for the reason that when once located the nut can be either loosened or tightened without having to shift the wrench. The chuck which accompanies the machine is of the screw and geared scroll type, having two wrenches, but, if made right, one would be sufficient.

The special wrench for the taper adjustment can be replaced by the chuck wrench. If the foregoing were carried out, it would reduce the number of wrenches to five (including one double-ender), which is more than enough, and would not in the least alter the appearance of the machine nor lower its efficiency.

A case directly opposite to the one just stated is a lathe in the toolroom about ten or twelve years old; said lathe has a double-end tool-post wrench which will perform all the operations commonly necessary, such as changing gears, setting the taper, adjusting the steady-rest, etc., and in addition to that I made the heads of the screws of a set of lathe dogs, ranging from ½ to 4 inches, to fit the same wrench. I think there ought to be considerable time saved by having the tool-post wrenches of a room or shop made double-ended and to a uniform standard, with the screws of the lathe dogs fitted to them.

Now, in order to show how the number of wrenches on a machine can be kept down, I will give a few figures on a machine we build here in the shop: The machine contains 12 set-screws, 16 adjusting screws, 28 adjusting nuts and 54 adjusting bolts; every one of these must be shifted for the different work and all this is done with two double-end wrenches. Designers of machine tools please note.

CHARLES P. THIEL.

Grinding Wood Patterns.

Editor American Machinist:

Grinding, as a profitable means of finishing wood pattern work, would on first thought appear to be too absurd to consider seriously, yet in "house work," or, more properly speaking, architectural patternmaking, where a diamondized surface is required, as on curbs, stair treads, landings and floor plates, I know of no better or quicker way than to grind the grooves that form the diamonds, using a coarse emery wheel shaped so as to make curved or obtuse angled grooves with its edge. By fitting the wheel to the circular saw arbor, with the cutting surface projecting enough above the table to give the desired depth of groove, and then fixing the fence on the sliding guide to any angle that will produce a diamond with the width at base center, one-half its length and hight one-eighth of same, diamond lumber of a high

order can be made that will not need any sandpapering after the surplus stock is removed.

The imperfections of the manufactured diamond lumber are such as may be expected when rotating or chisel cutters are used to make the grooves that form the diamonds, as it is plainly manifest that the cutters must cut against the grain on one side at each operation, and the work, consequently, requires good, hard sand-papering, else when varnished one side will present a very rough surface to the sand that will show distinctly on the casting. All this may be avoided by grinding the grooves, as it not only removes the stock quickly, but sandpapers it as well in one operation—a distinct gain, as anyone who has had the tedious and tiresome experience of hand sandpapering this class of work will admit.

If two or more coats of varnish are to be applied to the *bediamond* side, time can be saved by using a stiff scrubbing brush or clothes broom in lieu of sandpaper between coats, and, if passed over in almost any old way, with a fair amount of elbow grease, it will prove an excellent substitute.

OLD BOB.

A Boring Rig for a Pump.

Editor American Machinist:

The accompanying drawings of a boring device and the water end of pump will show how we accomplished what we considered—before arranging to do it—a troublesome job, but with the rig here described it was a very simple one. The job consisted of boring out the stuffing box and plunger fit of a 22x12x36 Jeansville duplex plunger pump. The pump, Fig. 1, was originally fitted with a bronze bushing at *A*, but not at *B*. The sulphur in the water had eaten the cast iron in grooves around bush *A* and had also eaten the stuffing box about ⅜ inch deep; so, as it was impossible to keep the pump packed properly, we had to bore out both parts and put in two new bronze bushes as shown. This pump was located in a bituminous coal mine about 270 feet below the surface, and could not be shut down very long at a time.

As will be seen, a boring bar that would go through the cylinder could not be used on account of the head between the cylinders, and to get this head out would have necessitated raising the pump off of the foundation bolts and disconnecting a number of heavy valve chests and pipes. Owing to the size of the pump room and the weight of the parts of a pump of this size, this would have been a serious undertaking; but with the bar which we made it was only necessary to remove the plungers and crossheads and slip the steam piston back in the steam cylinder. The steam cylinders are connected to the water end by four 3-inch round rods, and to these we clamped four pieces of 2-inch square iron to carry the castings that sup-

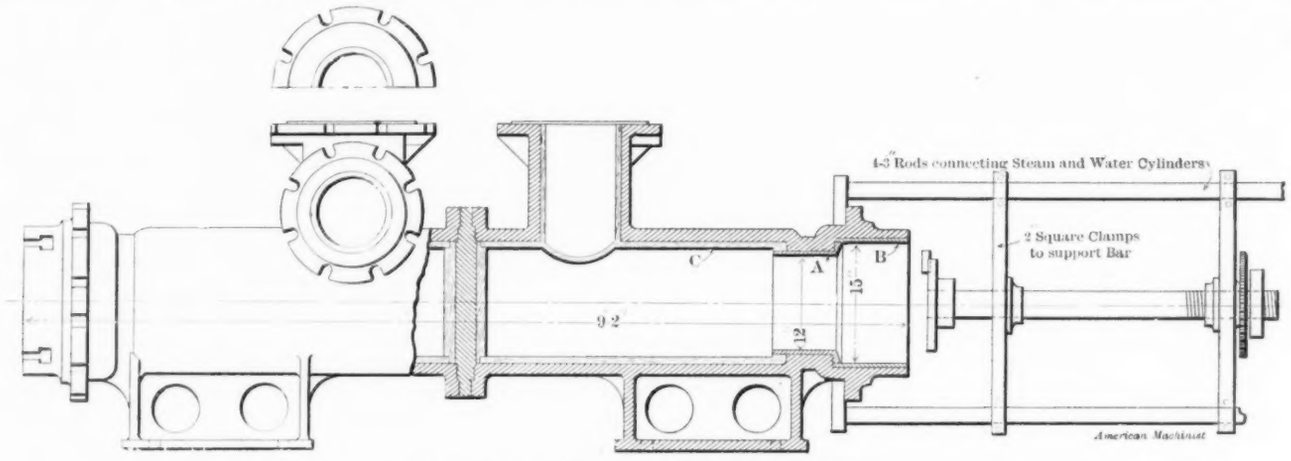


FIG. 1. THE PUMP WITH BORING RIG IN POSITION.

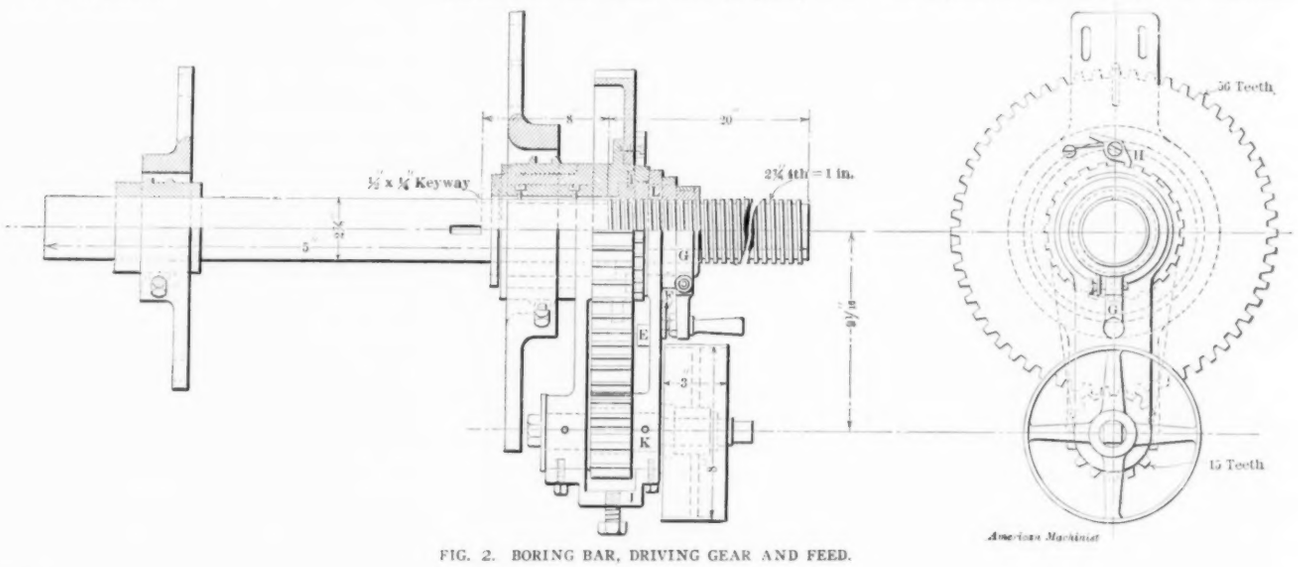


FIG. 2. BORING BAR, DRIVING GEAR AND FEED.

This idea of using the circular saw arbor, table and slide as a makeshift woodgrinder can be elaborated, and, to my mind, the ideal machine would be one suspended from and braced to the ceiling, with a group of wheels on the shaft, and with a base—fastened to the floor—having a table or platen attached that would be adjustable

ported the bearings for the bar. The bar was set in line with the pump by simply slipping it through its bearings until its ends projected into the stuffing boxes in the steam and water ends, when, by using a pair of calipers, it was centrally located.

A detailed description of the bar, which is shown in Fig. 2, may be interesting, as I have never seen one like it: The two gears were taken from the back gears of an old lathe in the shop, and castings and forgings were made for the other parts. The bar has a square thread on one end, and as long as nut *L* revolves with it the bar will not feed. But when pawl *H* comes into contact with the adjustable block *E* it swings out of its notch in the disk carried by the nut and the latter is then prevented, by the friction band *G*, from turning. The number of notches of feed can be varied by changing the location of *E*, every notch advancing the bar 1-100th of an inch. In case feeding by hand is desired, a round shoe is slipped on pawl *H*, to prevent it dropping in a notch, and latch *F* thrown back. The friction handle will then revolve with the bar until turned by hand in either direction, to advance or withdraw from the cut, as desired. The cutter head I used is not shown in the drawing, but consisted of a round forging which was keyed to the end of the bar and provided with a cutter that projected from the outside of the head. The cutter was fastened by a clamp at the side and rested on an eccentric ring which was turned inside of the head by a wrench, to adjust the tool to its cut.

The pulley shown on the boring rig we used when boring out flywheel hubs or crank-pin holes which were not over 5 inches in diameter; but to bore 15½ inches, as was necessary in the above pump, I made a speed reduction pulley, as shown in Fig. 3, which slips on the shaft in place of the other pulley. The casting which carries the large gear on this pulley, has an opening 1½ inches wide, to slip over the support *J*, Fig. 2, a 3⅜-inch opening to fit over the supporting arm at *K*, and two set-screws to hold the whole in place. This makes a very compact arrangement; the driving mechanism takes up very little room, and all the gears are encased.

C. K. WITMER.

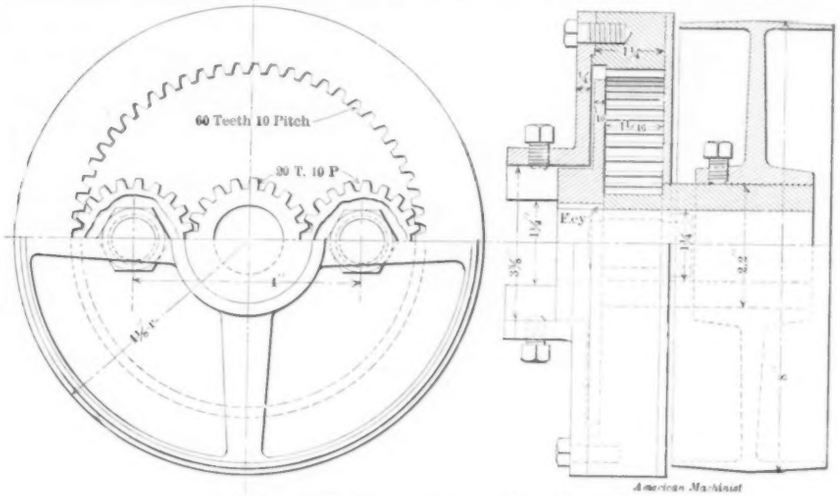


FIG. 3. SPEED-REDUCING GEAR FOR BORING BAR.

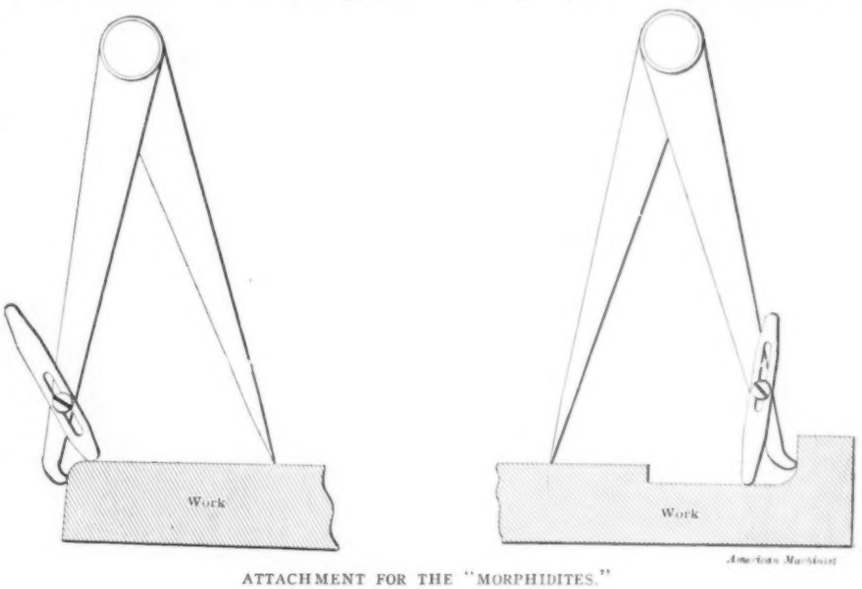
An Attachment for the "Morphidites."

Editor American Machinist:

The sketch shows an attachment, to be applied to "morphidites," which accomplishes the same results as in the tool shown by "Machinist," at page 1408, but which is capable of a much greater range of work, as shown in Figs. 1 and 2.

The attachment can be applied to the common form of "morphidites" and can be folded and clamped straight with the leg when not in use. It is made of sheet steel, about 1-16 inch thick, shaped and slotted as shown, and is held in place by a screw which enters a tapped hole in the leg.

M. H. BALL.

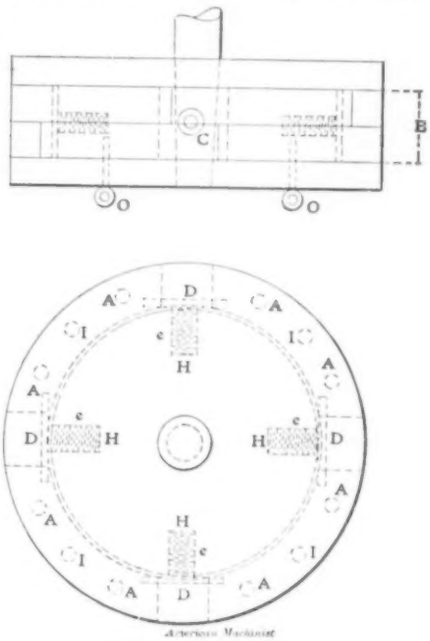


ATTACHMENT FOR THE "MORPHIDITES."

Piston Rings.

Editor American Machinist:

At page 1414 is an article on piston rings. I enclose a sketch of a ring which I think is the best ever put inside a cylinder. It is a ring having an even pressure all around, and therefore after the rings are worn out, new ones can be put in without reboring the cylinder. To make rings like the sketch, turn the outside of the casting to the bore of the cylinder and the inside to the size, or a little larger, than the bottom of the chamber in the piston head; then cut off two rings of such a thickness that the two together will fill the recess *B* in piston head. Fasten the rings together with pins *A*, then saw into three or four parts, according to the size of the cylinder, cutting the rings so as to make a lap joint *C* and cutting out under each joint a recess to receive a plate *D*, this plate to be the width of the two rings and long enough to rest on both parts with a short pin in the middle to hold spring *e* in place. Drill holes *H* in the piston head to a depth to give the



SPECIAL PISTON RINGS.

springs the proper pressure on the ring. Assemble the parts in the piston head, placing a clamp or wire around to hold the rings in place while a small hole *I* is drilled through the end of the piston head into each part of the ring about midway between the joints, and place in these holes pins *O*, having a hook or an eye on the end; then remove the wire or clamp, place the piston head in the cylinder, and, with a pair of pliers or the point of a file, remove pins *o;* and to my best knowledge, you will have a ring in that cylinder that will wear you and save you in steam more than any other ring on the market to-day, and if there is any reader that is in a position to try a ring of this make he would, I think, agree with me after giving it a trial.

GEORGE WOODBURY.

Toledo.

Depth Gage—Support for Large Planer Work—Diamond Point—Odd Planer Tools.

Editor American Machinist:

Fig. 1 shows a simple depth gage made of sheet metal. The body *A* consists of

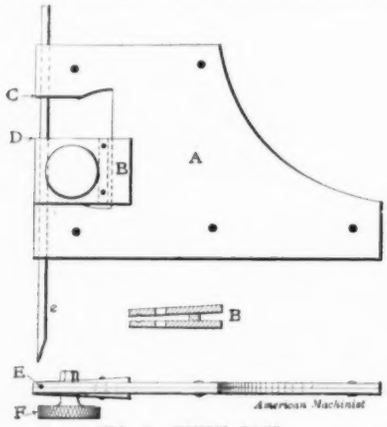


FIG. 1. DEPTH GAGE.

two pieces of steel about 14 gage, riveted together. A hole is drilled at *E*, a "slip fit" for wire *c*. *B* is made of two pieces of the same gage metal, with a small piece (the thickness of *A*) riveted between, as shown in the sectional view. The thumb-nut *F* binds *B* on to *c*. An important feature is the movement of *B*,

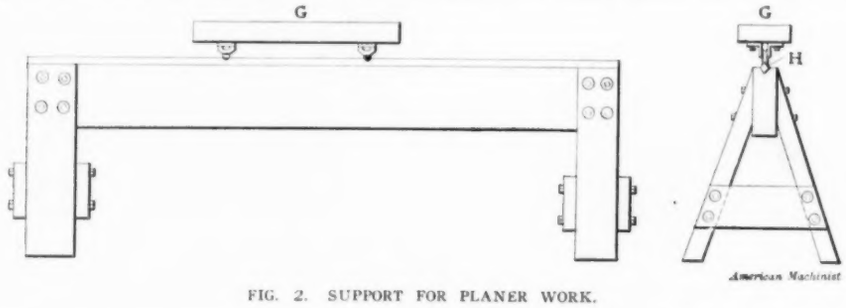


FIG. 2. SUPPORT FOR PLANER WORK.

from *c* to *D*, that enables the user to hold the gage square at the time the slot or hole to be gaged is nearly finished.

Fig. 2 shows a handy contraption to be used in connection with a planer, surface grinder or milling machine. Long pieces that otherwise would tip the platen are rested on the traveler *G*, and if a little care is used in lining the square cold-rolled piece *H* with the platen, the work need not be clamped on *R*.

A writer in these columns not long ago expressed his dislike in such strong terms

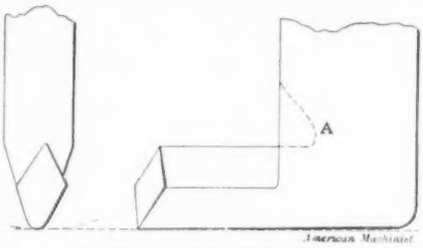


FIG. 3. DIAMOND POINT.

toward the diamond-point tool that I venture to lock horns with him. In substance, he considered the diamond point a back number. If he could drop into the shop of the Toledo Machine & Tool Company some time, I would be pleased to show him, first, how our tool dresser makes a diamond point, and, secondly, how to use it (on certain kinds of work, of course). Fig. 3 gives an adequate idea of the tool (most tool dressers relieve it at dotted line *A*) and the front view shows the way I grind it for wrought iron and machine steel. Oh, no, my friend, I can't discard the diamond point at present.

The tool shown in Fig. 4 is for cutting slots 7/8 inch deep, 3-32 inch wide, from 3 to 8 feet long in cast iron. I have the tool in service to-day, and it has traveled through about 5,000 feet on one job alone, to say nothing of smaller jobs. The temper is drawn within about 3/8 inch of the cutting edge.

Fig. 5 is an underside view of a "putting on" tool. Think of it, fellows—can you make use of it? Did you ever need one? But—let me whisper in your ear—you can not use it on every job, only on steel edges —such as tin cutting dies and punches. Instead of peening the edges are placed under this tool on a planer and rolled.

Fig. 6 is a "hog nose" of air hardening steel. I have always opposed the "cocking" of the tool on surface work—that is, having the cutting point otherwise than central with the "apron"—but as our tool dresser could not make my style of a "hog nose" he made a "square nose" and offset it. The tool has given such good satisfaction that I venture to reproduce it. I only use it on cast iron, however.

CARROLL ASHLEY.

Planing Lathe Beds.

Editor American Machinist:

Planing a lathe bed may be simple enough to those who have seen it done and are conversant with the general methods employed; but to many, on other lines of machinery, it is not quite so clear how they are planed so quickly or how the sides of the V's or ways are fitted so nicely, as it appears that two fits must be made at one time. That is not the case, however, and as I have never seen a description of this kind, I think it may interest some to see how easily a lathe bed is planed standard. The V's are at a given distance between centers, and of a certain width on top.

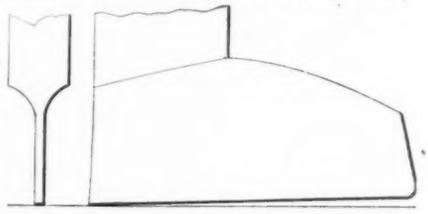


FIG. 4

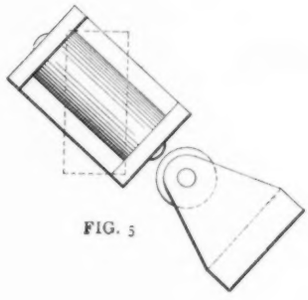


FIG. 5

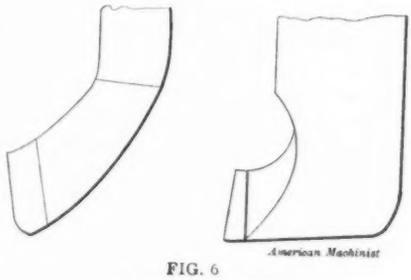


FIG. 6
ODD PLANER TOOLS.

After the tops of the V's and the flat surfaces between them have been roughed out, a large self-hardening tool of the proper V-shape is generally used to bring the V's down nearly to size quickly. Very heavy cuts are taken, the tool being kept well under the scale; this saves the tool and leaves less for the next tool to do. The front V's, *A* and *B*, Fig. 1, are planed down first, then the front surfaces of the back V's are planed, the templets, Figs. 3 and 4, being used to get the distance from *M* to *N* and from *K* to *L*. The back V's are now planed on the other side until the finishing templets, Fig. 5 and *F*, Fig. 1, come down to a solid fit. The top of the bed being scaled off to size the side cuts are taken down next the right distance from the center of the V's. The roughing undercuts are now taken for the rack seat,

the back gib on the carriage, and the clamp under the tailstock.

After all the heavy metal has been removed the clamps are removed, and if any twist is found in the casting it is of course repacked solid. The bottom of the bed, I should have stated, is planed the first thing, turned over and packed with paper at the four corners, and with solid packing at other points, according to the length.

The bed, being reclamped, is then straightened up all over with a nice, clean, light cut, using a broad tool on the V's and bringing them to a fit again. Then the tops of the V's are rounded off so that anything falling on them will not leave a nick or burr that will catch or stick the carriage. Finally, a very light skim is taken over the V's, leaving them true and bright. The finishing templet *F*, Fig. 2, shows at *E* where the tool is set to cut the rack seat a standard thickness; it also gives the setting for planing the back gib bearing of the carriage. By touching a standard square-nose at *H* the proper hight for the groove for the lead-screw boxes is obtained. The plug *G*, Fig. 1, gages the surface on which the box rests. These boxes are of course standard. The V's can be brought to a nice, clean finish with a single broad tool if it is made very keen and the planer run slowly. The skimming tool should be so made that its edge differs from the tool used before, in order to prevent it from following any chatter marks or unevenness left by the former tool. It may also be well to add that to get a good job in this way requires a good, stiff, level and smooth running planer, and a man who has had considerable practice, as I have known several that failed.

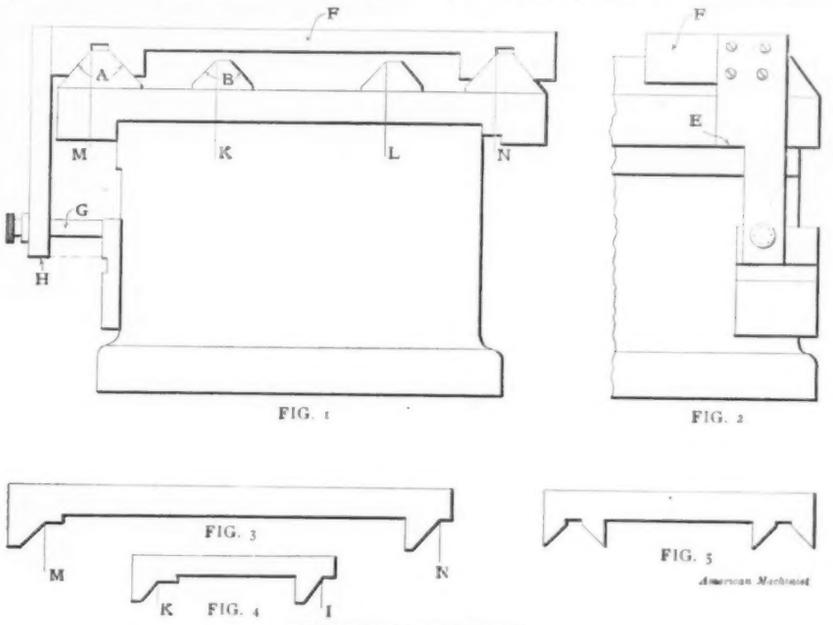


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5.

TEMPLETS FOR LATHE BEDS.

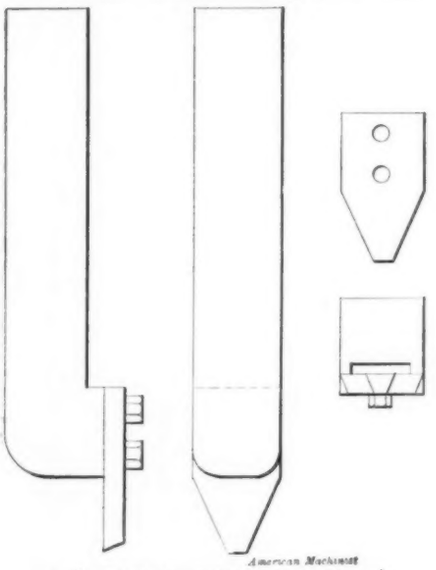


FIG. 6. TOOL FOR FINISHING LATHE V'S.

The whole trick in finishing with a large flat tool is in knowing how sharp to keep it and how much of a cut to put upon it. A very handy tool for finishing V's is shown in Fig. 6. The shank is of machine steel set back about an inch, so it may spring away from the work; this will also prevent it from chattering.

The back of the shank is recessed so that the steel blades may be sure to come down solid without rock or give. The blades, of which there should be several, are of the best tool steel, made very hard. They should be kept in the toolroom and ground there and a sharp tool given to the man in return for a dull one.

H. L. CAMERON.

An Oil Guard for the Automatic.

Editor American Machinist:

A liberal amount of oil was being used on the Spencer two-spindle automatic, and the second operation spindle as it ran forward to receive the work from the other spindle was getting, as indicated in Fig. 1, rather more lubricant than it required. Consequently, a fine spray of oil was thrown over the machine guards, more or less oil was carried back with the spindle into the head, and part of this oil then worked out between the pulleys and ran on to the driving belts. To divert the lubricant from its course until the spindle had been drawn back into place in the head and the work was in position to be operated on, one of the operators made and applied a guard as shown in Fig. 2.

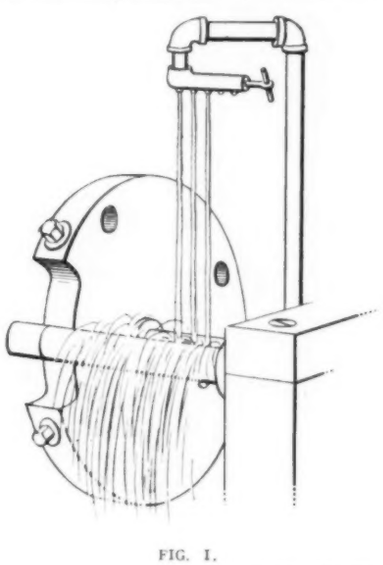


FIG. 1.

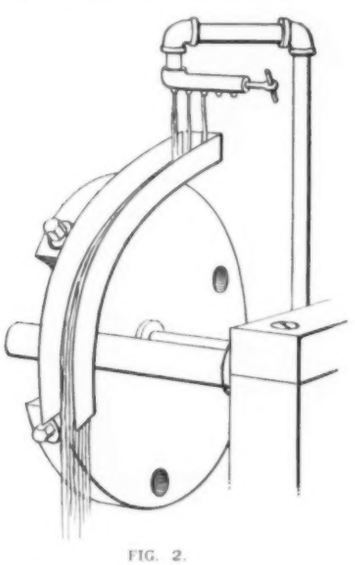


FIG. 2.

AN OIL GUARD FOR THE AUTOMATIC.

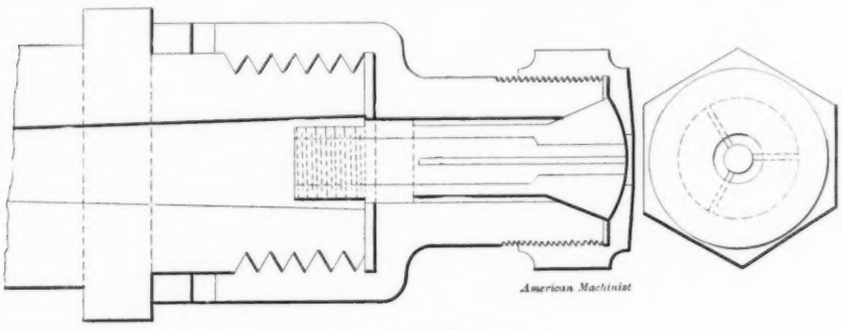
This guard was made of tin and curved to suit the turret. It was provided with two ears which were filed out to receive the turret tool binding screws, and was thus easily put on and securely held in position. In operation it proved very satisfactory, for it kept the spindle free from oil and yet in no way interfered with the working of the turret. S. F. ARTHUR.

A Push-in Chuck.

Editor American Machinist:

Some of our work demanded, at least for convenience, that we use draw-in chucks, but as the lathe we wished to use was not arranged for draw-in chucks an extension was screwed on the nose of the spindle and bored out to fit the body and taper of the chuck. A thread was cut on the outside of the outer end and a cap was made to screw on which forced the split chuck back into the taper, thus closing it; and, as the hole in the draw-in chuck ran true, I concluded the scheme was about as good as though it was to be used in the usual way by being drawn in from the back end. As the sketch shows the combination, further description seems unnecessary.

G. SCHNEIDER.



A PUSH-IN CHUCK.

A Slide Valve Job.

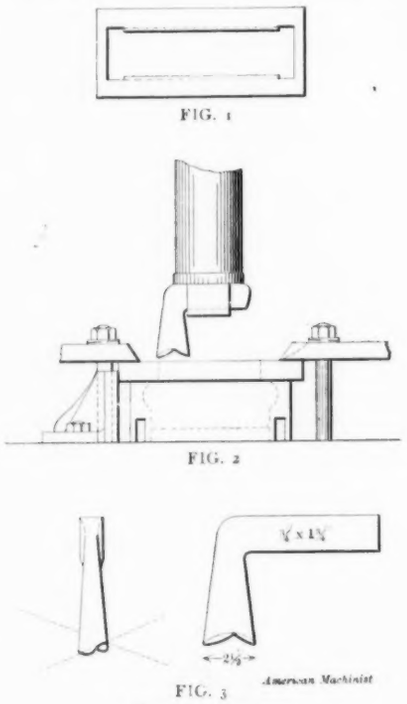
Editor American Machinist:

How strange it seemed to me to notice in a large manufacturing plant where locomotives are built for profit, a crude method of porting slide valves. Four notches were made, as seen in Fig. 1, and the cuts then finished on the planer.

The quickest way of porting these valves that I have ever seen tried or illustrated was by the use of a good 12-inch slotter fitted with the tool-post shown in Fig. 2 and the tool Fig. 3.

After setting the valve the nose of the tool was fed in to the line and the feed was then thrown in; one cut only was required on each side and a heavy feed 1-16 inch was taken. Water was used on the job and the cutting was done at a speed of 20 feet per minute. The time ranged from 15 to 20 minutes, depending on the length of valve, and most of these were of the largest kind used on the big engines. The total time per valve was less than the time taken in cutting the four notches mentioned above.

FRANK RATTEK.



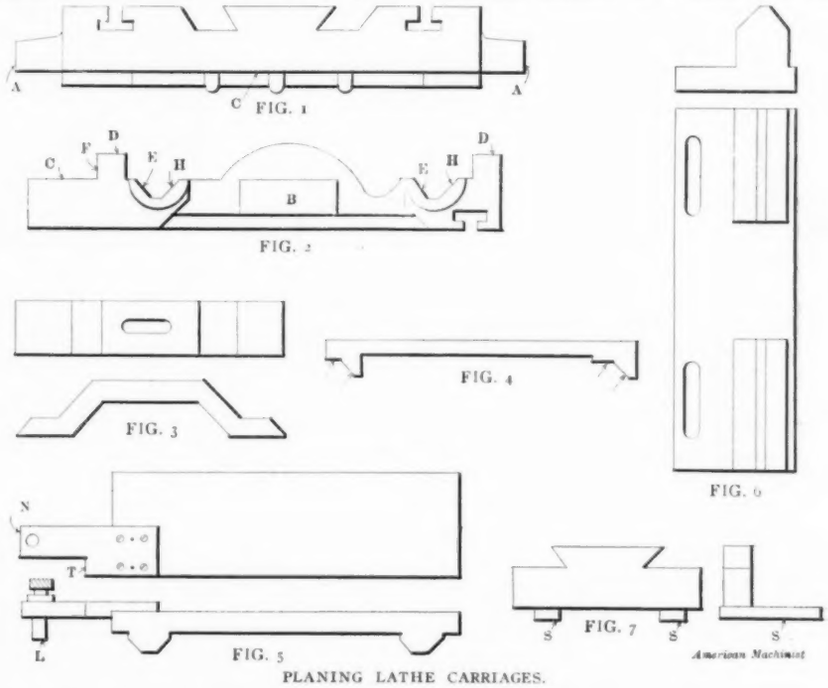
A SLIDE VALVE JOB.

Planing Lathe Carriages.

Editor American Machinist:

I had been working on wood-working machinery about six years and thought I might do better in some other line, so I started out one day, about twelve years ago, to see what I could find, and I landed in Push & Co.'s shops, where they make a specialty of lathes. As I was walking around the shop, I met an old friend—who was then running a planer working on lathe carriages—who informed me that he had given the boss notice that he was to leave that night, telling me to go after the job and not to take less than $2 per day nor get the carriages out in less than ten hours apiece, because they had never got them out in less than twelve hours before, and his time (ten hours) was considered fast. Well, to make it short, I got the job at $2.25 per day and piece-work at $2 per carriage, which was just what they had been costing them, the boss said. The first lot I finished up in 7½ hours apiece, 2½ hours' gain on each, which gave me quite a little extra money. I had finished several lots at about the same rate when I was changed on to another planer shorter than the first; this cut me out of a carriage at every setting and killed my chance of making extra money, and of course I kicked—for I was getting tired of doing one thing all the time, anyhow.

I was now put to planing lathe beds, and after planing a few I was able to cut the time on a 21"x10' bed from 20 hours down to 14 (this time has been reduced since a great deal). It may be said that I was killing things, so I will add that I never failed to get more pay when I turned out the work, though I always had to ask for it, which I never forgot to do. When I found that I had got about all there was for me at Push & Co.'s, I went to another shop on the same line of work, and here it was easy to beat records, as they were not as fast as at Push & Co.'s. I was put at V-ing a lot of head- and tail-stocks. They were put on mandrels, a pair at a time, and fastened in V-blocks. It had b en taking from 3 to 4 hours for each pair, and, after a lot or two, I got them down to 1½ hours per pair, or less than half the previous time. Then, after cut-



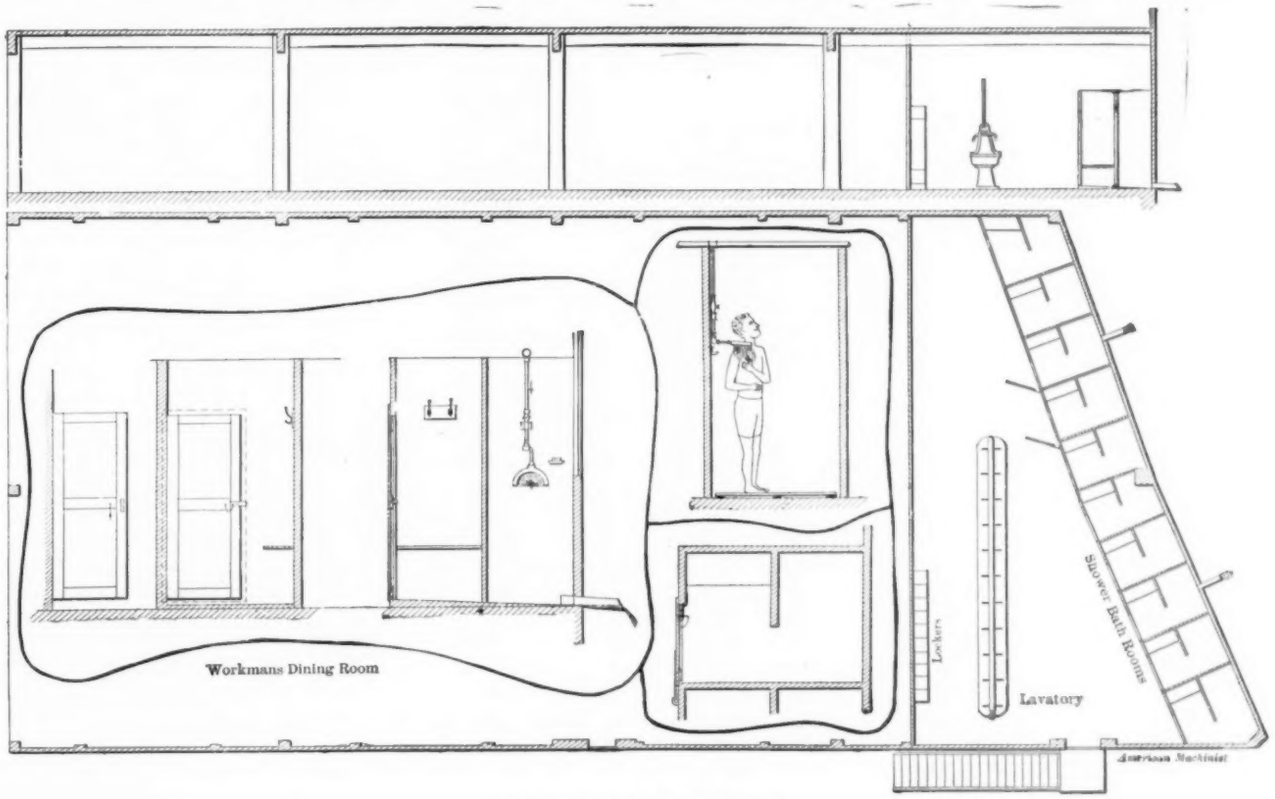
PLANING LATHE CARRIAGES.

ting time on 18-inch carriages down to 3 hours and 40 minutes apiece, I was given charge of the planer work, and have been a planer foreman ever since.

From the above tale it may be seen how twelve or thirteen years ago it took a man 10 hours, at 20 cents per hour, to plane an 18-inch lathe carriage, while I have lately had good men in my charge getting 27½ cents per hour plane these carriages (with the help of good jigs) in less than 3 hours apiece.

In the sketches may be seen two views of a carriage, and the planing jigs and templets that were employed to accomplish the above-stated results. The carriages, built in lots of 28 or more, are put on the planer, as in Fig. 1, seven at a setting, and roughed out all over on the top; the dovetail and the ears *A A* also are roughed down. The clamps, Fig. 3, are then eased up, a straightening up cut is taken off the flat top, and the ears *A A* and the pad *B* (for the follow rest) are finished down. The carriages are now turned over for the second setting, Fig 2. Clamping seven down, they are roughed out close to size all over, then loosened up and tested to see if they rest solid on the planer, after which they are finished up with a nice clean cut. The seat *C* for the apron is finished first to standard size. The bearings for the front and back gibs *D D* are next made to size with the same tool. The V's are now finished at *E E* to fit the templet, Fig. 4. This templet must touch at the four points marked by arrows. The finishing templet, Fig. 5, is used next. The V's are finished down the sides *H H* until the plug *L*, Fig. 5, just touches at *C*. This brings the apron to a standard hight with the top of the bed. The corner at *F*, Fig. 2, is next finished out, the tool being set just right by touching it at *T*, Fig. 5 This corner, when the apron is backed up to it, sets the apron the proper distance from the front of the bed. The front of the carriage is finished down correctly when the tool is touched at *N*. The carriages are now placed upon jigs like Fig. 6. The jigs when made are long enough to allow two pieces about 3 inches long to be cut from the end of each. These pieces are placed under the back V in the carriage. While the main jigs are bolted down squarely across th planer table in their proper places, the front V resting on them, the short ones locate themselves and are held down when the carriage is again fastened with the clamps, two clamps for each carriage being used. The dovetail is now finished to size. The form Fig. 7 is used to set the tools, and is held with the strips *S S* up against *C*, Fig. 1, while setting them. The jigs and clamps are made of cast iron and the slots are cored out. This job is done on a double-head planer.

H. L. CAM.



SHOWER BATHS FOR WORKMEN.

Shower Baths for Workmen.

Editor American Machinist:

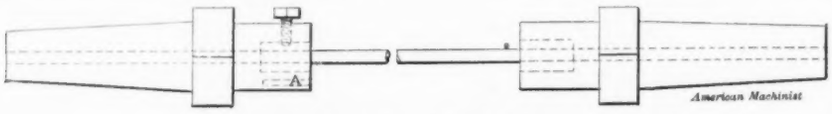
Shop proprietors in America realize that workmen for maximum efficiency must be in perfect hygienic condition, and so shops are ventilated by mechanical means, as much light as possible is secured, the shop is kept clean, and its cleanliness is supplemented by lavatories and shower baths for the workmen. We desire to have our workmen scrupulously clean, and we have noted with pleasure many physiognomies transformed since our installation of the latter conveniences. We would have been glad to have provided bath tubs, but these are difficult to keep clean, and we did not like the shower baths as they are commonly used, because the wetting of the hair gives headache to some, and at any rate may produce a cold. In the drawing are shown the arrangements we adopted. The space for the shower baths was partitioned off from the end of the dining hall. The bathrooms are each divided into two parts; in the outer one the workman undresses and hangs up his clothes, and in the inner room is the shower bath. The man washes his hands at the basins outside before entering the bathroom. The shower bath is a perforated pipe bent to a crescent shape; this may be adjusted to come over the shoulders of the man, according to his hight. At a sufficient hight there is a tank with a float and a steam injector regulated by a Heintz thermo-regulator, by means of which the water may be delivered at any desired temperature, according to the weather or other conditions. The doors of the rooms are fitted with a swinging latch or button, which normally hangs vertical. To fasten the door, the button is turned to the horizontal position, and the suspended pin at the side is inserted in a hole which is in both the button and the door. This fastening prevents anyone from disturbing the man and leaves the door open when no one is in.

Brussels, Belgium. A. BOLLINCKX.

Coiling Springs.

Editor American Machinist:

The sketch shows a simple arrangement for coiling heavy wire springs. In railway shops many springs are required to be made from wire 0.10 inch in diameter, the inside diameter of the spring being but ¼ inch.



ARRANGEMENT FOR COILING SPRINGS.

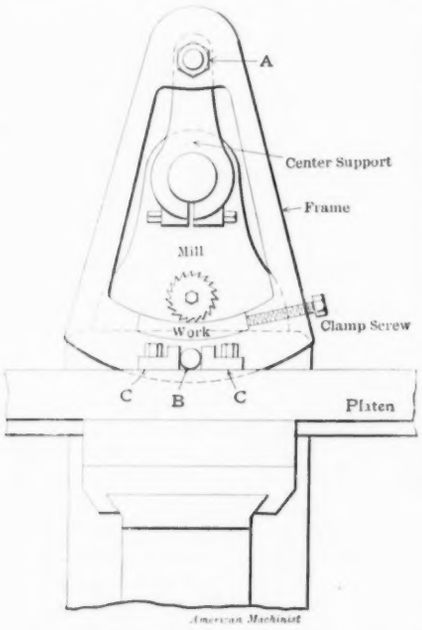
This work was generally done here by one of the boys, and was always considered a troublesome job, as the mandrel was so small and the wire so heavy that the former frequently flew out of the lathe centers. I suggested to the boy the device shown in the sketch. He was willing to give it a trial, and now would as soon coil those springs as larger ones. The centers were made from machine-steel bolts, the heads being left thick enough for a wrench. The holes were drilled clear through, eventually, so that bushings could be put in for other mandrels. In winding, the end of the wire was inserted in the hole *A* in the live center. It took but two hours to make this device, and it soon proved its worth, so no one need hesitate to give it a trial.

M. H. WESTBROOK.

Milling Brass Segments.

Editor American Machinist:

Having a number of small brass segments to finish, and not having a lathe large enough to take them, I made a frame to hold them in the milling machine, as shown in sketch.



MILLING BRASS SEGMENTS.

The center support was turned up and stud *A* used as a center on which to swing the frame. The bottom of the frame fitting in the T-slot in the platen was kept rigid and true. The stud *B* fastened in the frame worked between the blocks *C C*, which were bolted to the platen. The work was clamped by the set-screw as shown.

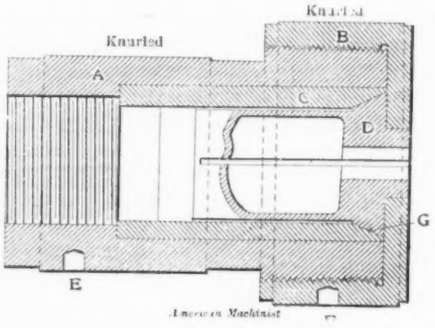
The feed being thrown in, the platen acting on stud *B* swung the frame, and the work was thus fed under the cutter and milled.

ELECTRIC.

A Chuck for Small Work.

Editor American Machinist:

The lathe chuck shown in the accompanying sketch was one that I made to fill a long-felt want. It is an invaluable adjunc for toolroom work, as will be recognized by all. It is easily made and rigid in construction. The length is 3½ inches. The cap *B* is 2½ inches in diameter. The stock runs perfectly true. The body *A* is fitted to the lathe and is made of machine steel. The cap *B* is made of machine steel and case hardened. At *F* is shown a hole for the Almond drill chuck wrench used to tighten the cap. The cap is knurled, and for ordinary purposes, such as light turning, filing and drilling, can be screwed up by hand tight enough to hold the work. The sleeve *C* is made of tool steel hardened, and ground and fitted to body *A*. The taper at *G* corresponds to that of the B. & S. chuck. While this sleeve makes a good job, it is not essential, for the B. & S. chuck can be fitted directly to the machine-steel body.



A CHUCK FOR SMALL WORK.

G. L. E.

An English Tool Holder.

Editor American Machinist:

A friend sends me the enclosed photographs of a tool holder—for general lathe work—which is particularly handy for screw cutting, as the tool may be swiveled to give the correct side rake or clearance for either right- or left-hand threads.

Fig. 1 shows the tool holder ready for action. It will be seen that steel of knife section is used for making the tools. The shank, being grooved the entire length, allows long tools to be used. Reference to Fig. 2 will show how the head of the holder is slotted, to permit the gripping pieces *B* and *C* to rock to give right- or left-hand clearance, as desired. It will be noticed that the groove in piece *B* is machined out to fit the broad edge of the steel, and the groove in *C* to fit the narrow edge. Fig. 1 shows the tool fixed at the right-hand side of the holder, but when it is desired to cut close up to the headstock, *B* and *C* are turned over in the holder and the holder turned upside down, bringing the groove to the left-hand side and the wide edge of the tool again to the top. The gripping pieces may be replaced by others having wider or narrower grooves, to take tools of varying widths, and steel may be obtained ⅛, 3-16 and ¼ inch wide at the top. I have personally used this tool holder, and found it perfectly rigid under heavy cuts. There is no tendency to spring, as upon tightening the nut the gripping pieces close in, binding the tool firmly by its narrow edges, and the depth of the steel is such that the tool is firmly secured before the gripping pieces are pulled entirely home.

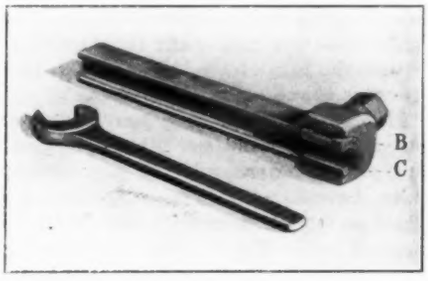


FIG. 1. ENGLISH TOOL HOLDER.

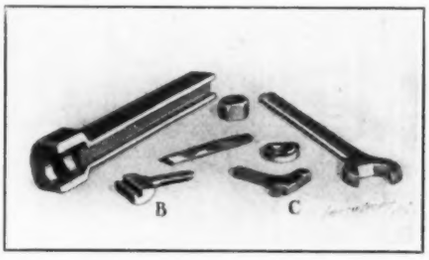


FIG. 2. ENGLISH TOOL HOLDER.

FRANCIS W. SHAW.

Birmingham, Eng.

For Correct Depth of Cut When a Gear is Not True.

Editor American Machinist:

It is often the case that either the gear blank to be cut or the arbor on which it is to be cut is not perfectly true, and then the question arises as to the proper way to set the cutter to exact depth, as indicated in the table. I strike a happy (?) medium and the gears always mesh properly, even though placed on shafts with fixed centers.

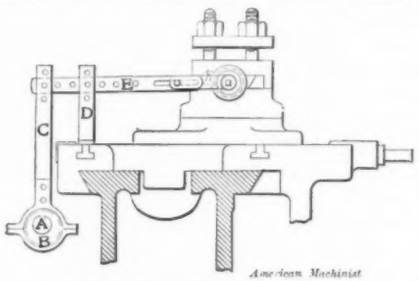
The method is simply this: Set the gear cutter central in the usual way and then place the arbor with the gear blank between the centers, leaving the dog loose. Start the machine, and with one hand raise the table and work up to the cutter, the center of the width of gear blank having been previously set under the center of the cutter; then with the other hand keep rotating the arbor and gear blank, and watch the cutter until it just barely touches the high part of the blank, then tighten the dog on the arbor and in the driver and give the blank one-quarter of a turn, usually ten turns of the crank. Raise the table so that the cutter just touches the blank, then go in to the proper depth. This method gives excellent results, as regards true pitch diameters.

ROBT. H. LACHMANN.

Ratchet Feed for Compound Rest—Cutting Long, Slim Screws.

Editor American Machinist:

Working in one of the large Lancashire shops a few years ago, I worked alongside an old turner on a 15-inch center

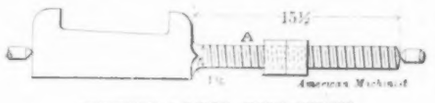


RATCHET FEED FOR COMPOUND REST.

lathe, who obtained a self-acting motion for the compound slide rest as shown in the accompanying sketch. Although not a new idea by any means, it is very little known here. A small eccentric *B* is placed on the splined back shaft *A*, and the eccentric rod *C* gives motion to the horizontal lever *E* from the fulcrum *D*. The lever *E* has a slot about 4 inches long cut in the end, as shown, to allow the free movement of a pin screwed into the small lever which carries the pawl which actuates the ratchet wheel on the screw end as shown. When not in use the rig can be disconnected in a few seconds and the eccentric shoved to the far end of the back shaft, out of the way.

CUTTING LONG, SLIM SCREWS.

Frequently having large quantities of gibs to turn, like the accompanying



CUTTING A LONG, SLIM SCREW.

sketch, in light American lathes, we experienced great difficulty in holding them steady while screw cutting. After trying various methods I found the following one the most satisfactory; first to cut the thread part way up the shank; about up to the mark *A* in the sketch. This we could do without any difficulty. We would then screw two ordinary hexagon nuts on and lock them, and then turn them to a true surface outside and run them in a steady-rest, leaving sufficient room behind for the tool to finish the thread up to the curved portion, as shown. The nuts could be taken off and used for others in succession without further trouble.

Wigan, England. J. GREEN.

Right and Left-Hand Screws—Belt-Shifters.

Editor American Machinist:

Perhaps a little on this question from the standpoint of an Englishman accustomed to both the British and American methods would prove of interest. Until quite recently, manufacturers over here were altogether at cross purposes, and shops blessed (?) with a conglomeration of old tools know it well. I've been there myself. In one case I happened to be running two lathes, the tailstocks of which were provided with different handed screws. The one I was most accustomed to using was an American lathe with a right-handed screw; the other, an English one, having a left-handed screw. The job in the English lathe was fairly heavy, and a roughing cut was being taken. The only attention it needed was to keep the center well oiled and tightened up to prevent chattering. I managed all right for some time, remembering the left-handed screw; but at last one day I forgot it, and in tightening up with the hand-wheel, I turned it the wrong way, letting the work fall, and down it came on to the cross-slide screw, bending it and generally spoiling it. Time after time I have seen work spoiled by turning the screw the wrong way, and particularly on the planer. The man who could always manage without accidents would have to be particularly "habitless."

The majority of modern makers, however, are practically unanimous on the point, providing in cases where the screw does not move with the slide a left-hand screw, and where the screw moves *with* the slide a right-hand screw. Following this rule the tailstock barrel is made left-hand, and no inconvenience whatever is felt, for it is instinctively the practice to stand facing the hand-wheel when feeding for drilling, etc., and it is far easier to move the wheel clockwise than otherwise. Perhaps this is more habitual here than with the Americans. Only recently I have come across a case. A firm over here has in stock an American machine for a particular operation in machining. It is arranged so that the operator stands at the front of the bed (the machine is in lathe form). It has been found impossible to sell this machine, because the practice here is to have a short bed enabling the operator to stand at the end; and this, I am convinced, is absolutely the better practice, inasmuch as more power can be applied, or, rather, the power can be applied with less bodily exertion.

Personally, too, I prefer a hand-wheel to a handle, and there is not much need to fit a handle into the wheel rim, as the barrel should be so free a fit that a swing of the wheel will move it easily. The practice is to rapidly swing around the wheel, drawing the drill from the hole, and then to brake it by a hand touch, stopping it before the drill has retreated too far from the hole, so that it is just in the right position for the next piece.

Whatever unanimity there may exist in screw practice, there is none whatever in the belt-shifter problem. Makers have a varied practice in the way of fixing on the fast and loose pulleys, if, indeed, they have any rule at all. I guess they put them on pretty much at random, for it appears as though they consider the countershaft as an extra, for they begrudge, as a rule, the supply of anything but the bare hangers, shafting and pulleys—no strap guides or rods being provided in some cases. It would never do to spend half a minute in considering which way to put the pulleys on.

Now, this want of uniformity is not only very inconvenient, inasmuch as much time is lost when men are shifted from machine to machine, but it is positively dangerous. Suppose a man has his whiskers, hair or clothing entangled in the work. Now, which way must he move the shifter? He ought to know at once which way, or by the time he has recovered from his first effort to move the rod the wrong way, his head or what-not is drawn to the work in such a position that the shifter is out of reach. In a similar case, I have known the rod broken off by the unusually sudden attempt "to move a stone wall," and had it not been for the man's presence of mind in throwing off the cone pulley belt, he would have been badly damaged.

In all cases it would be preferable to arrange to stop the lathe or other machine by a movement to the left. In many cases it is convenient to keep the hand on the shifter in order that the belt may be quickly shipped on or off. The left hand should do this light, or, rather, unskilled work, while the right hand is attending to the feed screws, etc., and it is my impression that the right-for-starting, left-for-stopping movement would be the handier.

In cases where two speeds are employed, of course, the speed considered should be the normal one.

But what's the matter with the pull-for-start, pull-for-stop arrangement, one pulling place or handle only?

FRANCIS W. SHAW.

Birmingham, England.

The value of the timber imported into Great Britain in 1901 was 10 per cent. greater than that of the pig iron produced in the same year.

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School Shop Instruction.

We wish that every teacher in a manual training or trade school or engineering college shop might read the article by Mr. Markham in another column. There is an element of unconsciousness about the article that indicates plainly enough that its author does not realize the good work he is doing. For ourselves, we must say that the pieces of work shown illustrate the best laid-out course instruction of this kind which we have ever seen, and, more than that, one which almost stands in a class by itself.

We have always had some feeling of tolerance for the purely exercise scheme of shop instruction, but we shall harbor it no longer. By the exercise scheme we mean the scheme of selecting exercises having no other purpose than instruction and acquirement of skill—the work having no value as work when done. The standard argument for this system is that by it alone can the pupil be given work suited to his needs as a learner and not be kept doing work with which he is already familiar. The argument goes further than this and asserts that on any other plan the student will, for the good of the product, naturally be kept on work which he can do best, instead of, as should be the case for his own good, on that which he can do the poorest, and hence in which he most needs instruction and practice.

While we have always believed in the great desirability of doing work that is useful in itself, there is a great appearance of plausibility in this view, and we have been disposed to conclude that the exercise plan is the best for the early work, to be followed by other work as soon as the student is able to do it acceptably.

Examining Mr. Markham's illustrations, what do we find? An admirably selected set of progressive exercises, bringing in one operation after another in excellent sequence and *scarcely a useless thing on the list.* The least shoppy thing of all is the stab file, and with that exception every piece represents something in daily use, while most of them are of the highest utility in any shop, and a good proportion are just the things which every mechanic is glad to have in his kit.

It is not difficult to discover the principle which lies at the bottom of this, though very likely Mr. Markham may never have thought of it. As Professor Sweet has said, "The right thing is usually done and then the laws of right are discovered," or words to that effect. The objection to making useful things in a school shop is, when we think of it, based on the tacit assumption that the things must be machines. In that case the machines cannot be sacrificed to the sudents' needs in the way of instruction, and it naturally follows that the best work is given to the best student workmen, instead of the reverse, as it should be, for the students' benefit. Mr. Markham has cut the Gordian knot by making *tools* and not *machines.* Each tool stands by itself. A bad piece of work can affect nothing but itself, and there we have it. The poorest student workman in the shop jeopardizes nothing but the piece he is working on, and, if it fails to pass muster, he may repeat the exercise with no loss except the stock involved. It is as simple as Columbus's standing the egg on end.

The Land of Unbounded Possibilities.

The above title is to be given to a series of articles on conditions in the United States, prepared by Hon. Ludwig Max Goldberger, of Berlin, Royal Privy Councillor of Commerce and member of the Imperial German Consultative Board for Commercial Measures, to be republished by the Treasury Bureau of Statistics.

The articles are the result of an eight months' official tour of the United States, in which the writer made personal observations and investigations into industrial, commercial and economic conditions. His reports were made direct to the Emperor and the Minister of Commerce, and have not yet been officially published. Meantime, however, he has published in a leading weekly journal of Berlin a series of signed articles, from which the following are extracts:

"The United States, like an enchanted garden, has brought forth from a marvellously productive soil splendid results of human ingenuity. Yet the thing that causes most wonder is that the concentrated intelligence which, intending to replace human factors by machinery, has, in working towards its aim, been giving to constantly growing numbers of workmen an opportunity to support themselves and become productive factors. The joy at the size of their own land encourages each individual. It makes him communicative and friendly to foreigners who are seeking information. It seems as though everyone were filled with the idea: 'The stranger shall see how great and strong America is.' Everywhere I found open doors inviting me to enter, and nowhere did I find the slightest attempt at secretiveness. Everywhere I observed an uncommon but steady bustle of men who enjoy their work and are consciously working for great results.

"The inhabitants of the United States, including Porto Rico, Hawaii and the Philippine Islands, number about 88,000,000; that is, barely 5 per cent. of the world's total inhabitants, according to its highest estimate. This 5 per cent. has at present taken possession of 25 per cent. of all the cultivated area of the earth, viz.: 407.4 million acres out of 1,629.3 million acres. A land of marvellous fertility offered itself for tillage, and the husbandmen had but to gather in the produce. The virgin soil made his work easier, and its extensiveness rendered the application of artificial fertilizers practically unnecessary, although the agricultural offices of

the States and the Union have constantly, by excellent advice and practical expert assistance, been furnishing the ways and means towards more intense cultivation.

"The world's total product of corn for six years fluctuated between 2.6 and 3 billion bushels per annum, a total of 16.6 billions for the period, with an annual average of 2.77 billions. Of this amount the United States alone produced 12.4 billions, an average of 2.07 billion bushels per annum, or 75 per cent.

"Toward the world's wheat crop the United States contributed in the five years, 1896-1900, 20.7 per cent., while for the year 1901 its contribution to the world's production of wheat amounted to 25 per cent. During the years 1896-1900 there were grown 14.7 billion bushels of oats in the world, and of this 3.74 billion bushels, or 25.5 per cent., were produced by the United States.

"It produced very nearly 36 per cent. of the total iron produced, and that of the very best quality. In the past year the United States produced 39.3 per cent. of the world's product of pig iron. In 1900 it produced, roughly, 10.1 million tons of steel, or 42 per cent. of the world's product, and in the year 1901 the United States output was increased to 13.5 million tons.

"The United States produces nearly 55 per cent. of all the world's copper. From modest beginnings this industry grew by leaps and bounds. In 1870 the copper production of the United States amounted to 12,000 tons; in 1880 its production had increased to 27,000 tons, out of a total world production of 153,000 tons; in 1890 the United States produced 116,315 tons of the world's product of 269,455 tons. During 1895 it controlled more than one-half of the world's production, and at the end of the century the United States produced 270,000 tons, or more than the world's entire product had amounted to ten years before.

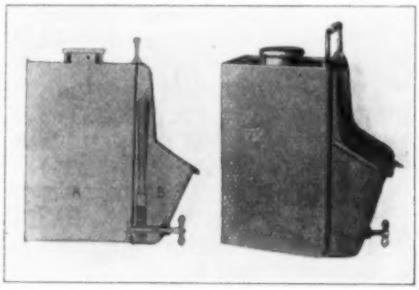
"The output of lead in the United States since 1895 has increased to such an extent that it has wrested from Spain the position of primacy in the world's production. The rivalry of the United States in the production of quicksilver has been equally strenuous. In 1900, for the first time, Spain's product is slightly exceeded by that of the United States.

"The total world's production of gold for the year 1900 was estimated to be 255.6 million dollars; that of silver represented a coinage value of 223.5 million dollars. For the year 1901 estimates for both metals amount to 265 million dollars. In each of the two years the United States showed the greatest share of both metals, 31 per cent. for gold and 33 per cent. for silver."

Some New Things.

A NEW VARNISH POT FOR PATTERN SHOPS.

The object of this pot is to prevent the evaporation of alcohol. The varnish or shellac is placed in the large compartment *A* and cut with grain alcohol as thick as it is possible to cut it. By means of a screw top, the compartment is made perfectly air tight and the alcohol cannot evaporate. When wanted for use, the varnish is let out into compartment *B* through valve *C* in any quantity desired, and thinned up with wood alcohol ready for use, thus saving the expense of thinning up a quart or more of varnish when only a spoonful is required. The pot is 5x5x9 inches high,

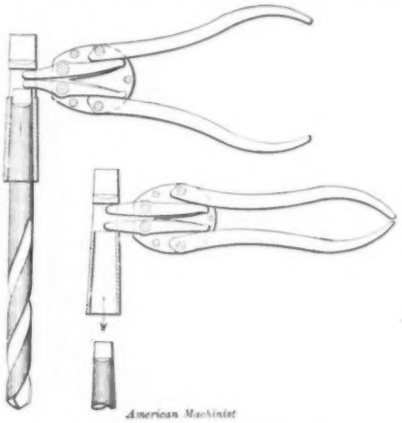


NEW VARNISH POT.

and holds one gallon. It is substantially made to stand rough usage. All parts coming in contact with the varnish are made of brass and will not discolor orange shellac. It is manufactured by the Diamond Clamp & Flask Company, Richmond, Ind.

TOOL FOR REMOVING DRILLS.

A German inventor, Martin Steudner, has patented in the United States the tool



TOOL FOR REMOVING DRILLS.

shown in the sketch for removing drills. The device will be understood without a word of explanation.

Technical Publications.

"Machine Shop Arithmetic." Third edition. By F. H. Colvin and W. L. Cheney. 131 4x6-inch pages, with illustrations and tables. The Derry-Collard Company, New York. Price, 50 cents.

We are glad to notice this excellent little book again, especially as the fact that over 7,000 copies have been sold indicates plainly enough that it has met a real want. To the many mechanics who are frightened at the idea of decimals, the explanation of those really harmless things is alone worth the price of the book. The explanation of the method of finding the change gears for screw cutting—a standing problem regarding which we expect to receive regular inquiries as a matter of course—is also, like the rest of the book, of immediate interest to every machinist. At the end of the book is an excellent explanation of the metric system with conversion tables between metric and our more familiar units.

"Reference Library Modern Engineering Practice." Edited by F. W. Gunsaulus, assisted by twenty-five assistants. Ten volumes, containing a total of nearly 4,000 4½x9½-inch pages, with over 2,000 illustrations. The American School of Correspondence, Chicago.

This series of volumes is not, as might be inferred from its title, a sort of encyclopedia for the practicing engineer. The nature of the contents is much more nearly that of the instruction papers sent to their students by the correspondence schools. Thus the first volume takes up Arithmetic and Algebra; the second, Geometry, Trigonometry, Mechanics and Heat, and the others in succession, Pattern Making, Foundry Work, Forging, Machine Shop Work, Machine Design, The Steam Engine, Boilers, Electricity, Mechanical Drawing, etc. The advantage of such a set of books over such a selection as the student can make for himself is that they form a consecutive whole. At no stage of his work will the student find himself lacking knowledge of things necessary to further progress, and, on the other hand, the aim being the accomplishment of results, no time is spent in exploring by-paths for the sake of presenting a complete or symmetrical development of a given subject. There can be no question that the contents of these volumes form an excellent foundation for useful technical work as well as for additional special study on such lines as the student may feel like following, or as the work with which he is connected may impel him to take up in greater detail. The books are intended for the students of the American School of Correspondence and are not, at present, offered to the general public.

Inks in the Patent Office.

The following has been a standing order of the U. S. Patent Office for some time past:

(ORDER NO. 37.)

All applications, communications and other instruments in writing or print, which should properly constitute a permanent record in this Office, must be prepared with a substantially permanent ink. Anilin and other perishable inks will not be accepted.

In addition to this, an order has recently been issued for the actual testing of the inks of all documents which are to

become a part of the permanent record of the office. The following is a copy of the order referred to:

(ORDER NO. 1,506.)

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., Nov. 6, 1902.

The application-room and the mail-room will hereafter test all applications, communications and other instruments in writing or print, which should properly constitute a permanent record in this Office, filed in their respective rooms, which have the appearance of being written in fugitive ink.

Those which are unable to stand the tests required—first, the application of the well-known Labarraque's solution, followed by a saturated solution of oxalic acid, to determine whether the ink will be faded by the action of light or chemicals, and, second, the application of a 10 per cent. solution of nitric acid—will not be made a part of the Office records, but will be returned to the writers.

F. I. ALLEN, Commissioner.

Barth's Lathe Speed Slide Rules—Errata.

We regret that some errors crept into the article under the above heading, published at page 1684. In the twelfth, fourteenth and eighteenth lines of the third column of page 1685 the results shown by the instrument in the outer circles are given as in feet per minute of circumferential speed. In all these cases the figures give the revolutions per minute—not the circumferential speed.

How much of truth there may be in the personal attacks that have been made upon Herr Krupp, we do not pretend to know, but probably there is very little or none. There is one feature, however, pertaining to the works management which on the face of it seems capable of improvement. If, as alleged, workmen have been required to contribute from their wages to a relief and pension fund from which fund they could draw pensions only after twenty years of continuous service; and if they forfeit all claim to this fund if their term of employment ceases for any cause except disablement, then it is evident that an injustice is done. Perhaps, however, this is not the whole of the story, and from what is known of Herr Krupp's attitude in industrial and social matters it is safe to conclude that at least he did not intend to do otherwise than what was fair and right.

President Roosevelt, in addressing the members of the British Labor Commission last week, said:

"More and more as our modern industrial progress goes on there is a tendency to work in federation or combination, both among employers and among employees, in corporations, and in unions, and, of course, gentlemen, among the reasons why I take a very great interest in these combinations is the very fact that by their power they have such great possibilities for good, which necessarily implies that they have also great possibilities for evil, whether you wish them or not.

"It is idle, in my opinion, to protest against the inevitable tendency of the times toward both corporation and union. It is worse than folly to take exceptions to either corporation or union as such. The line should be drawn on conduct."

The 16-inch gun, in the building of which at the Watervliet Arsenal our readers have been interested, is now being transported to the proving grounds at Sandy Hook, the Merritt Chapman Dredging Company, of New York, doing it by contract for $5,400. The gun weighs 130 tons. The proof gun carriage is being built at the Watertown Arsenal.

The National Non-Partisan Reciprocity League will hold a convention in Detroit, December 10 and 11. Prominent speakers will attend.

We are informed that the Deutsche Niles Works, in Berlin, closed down indefinitely November 1.

Personal.

F. E. Drake, who was the director of the American end of the Machinery Exhibition at Paris in 1900, and who has since that time been in Berlin, has sailed for this country, and will arrive here in a few days.

It is announced that Mr. Edwin Reynolds, for so many years general superintendent of the E. P. Allis Company and later chief engineer of the consolidated company, has been made consulting engineer of the entire concern. His nephew, Irving H. Reynolds, who was made general superintendent at the time of the change in official titles, is advanced to the position of chief engineer. The position of general superintendent is thus for the present left vacant.

Obituary.

James E. A. Gibbs, inventor of the Wilcox & Gibbs sewing machine, died at Rappine, Va., November 25, seventy-three years old.

George C. Pettis, treasurer of the Hoggson & Pettis Manufacturing Company, New Haven, died at Hartford, November 20, sixty-nine years old. He was born in Plymouth, Conn., learned the machinist's trade, and at the age of 21 was in the employ of the Davenport-Mallory Lock Company, of New Haven. He was connected with the Russell & Erwin Manufacturing Company, of New Britain, seventeen years and then went to New Haven, where he joined the Hoggson & Pettis Manufacturing Company.

Commercial Review.

MONDAY, December 1, 1902.

The month of November in the machine-tool industry was marked by a lull in trade, thought by many to be only natural at this time of the year. Yet the business done was along profitable lines. The only difference between it and the business done for several months prior was simply that there was less of a rush to it. Yet this does not necessarily mean, and as we have already intimated, that business was poor. This is far from being the case.

The situation which prevailed during the month may be compared to a man who was formerly called upon to work day and night, but whose services were afterwards only required during the day. This, of course, meant a decrease in the man's weekly resources, but his earnings weekly nevertheless were satisfactory. In like manner with machine-tool makers and sales agents during the month. They were not in receipt of as many orders in November as they booked during September or October, for example, but the orders received by them during the month formed a profitable business nevertheless.

We have already stated that our advices are that the slight let-up in trade is thought to be temporary. This view is generally accepted in machine-tool circles. In the latter the outlook for business is regarded as excellent. Several houses informed us that they were called upon during the week to furnish bids on machine tools, the orders for which may not be given until after the new year.

Some of these tools—we have in mind a large milling machine in particular—could not be delivered until after the new year, even if the order were given now. We state this to call attention to what appears to us to be one of the peculiarities of trade. The man who wants this milling machine needs it now just as well as next January, when he admits himself that he will positively give the order for it. Why don't he give the order for it now, particularly since he will neither get it before then and will not have to pay for it until then? A valid reason is hard to surmise, but what we have stated is a condition, and not a theory. Yet such incidents as this are cropping up every day, and will doubtless do so during the present month. Because of all that has developed in this connection recently, and because of the business they know to be in sight, many houses take a rosy view of next year's prospective business.

Frank H. Mason, Consul-General at Berlin, writes to the State Department concerning machine tools and machinery in Germany as follows:

"It is well known that Germany is now passing through a period of industrial depression, and has to a great extent restricted the erection of new manufacturing establishments which, during the period from 1898 to 1900, made such large demands

on the purveyors of American machinery and tools. It is also true that those imported lathes, planers, milling and other machines have been used to reproduce themselves and to make many kinds of machinery and tools so excellent in quality and cheap in cost, that Germany has become a self-supplying exporter of many such appliances which were formerly imported from the United States. But while all this is true, there is still a demand in this country for many special forms of machinery and other manufactures of iron, which is only apparent to those directly concerned in that class of trade. From a leading house of this class, whose specialty is the newer forms of American machinery, the following résumé of the more obvious recent demands has been obtained:

"In Berlin and its vicinity, there is a call for the most improved machinery for making bolts, screws, rivets and all that is included under the general category of boiler fittings. One firm will take six sets of such machinery, which must be of the latest and most improved construction. Steam pumps of a capacity to lift about 15,000 gallons per hour, with minimum outlay of power, would also be found salable in this country.

"Machines for pressing oil from linseed, rape, sesame, palm and other oleaginous seeds and nuts, are understood here to be made of high efficiency and relatively cheap in the United States. So far as is known, the American machinery of this class has not been introduced here, and there would seem to be a promising field for it."

Local manufacturers of machinery have been informed that plans are now being perfected for the control of the entire output of the mining machinery in Ohio and Pennsylvania for the Connellsville Manufacturing and Mine Supply Company, with a capitalization of $30,000,000. We have been unable to find anyone who can give any definite information in the matter.

Recently a large number of rumors have reached us of certain contemplated schemes of interest to the makers of machinery. Being in the business of tracing the genealogy of such things, we frequently, in fact invariably, find upon investigation that they haven't any. A leading manufacturer to whom we communicated our troubles in this direction said:

"These erroneous reports reach us almost daily. It is due to the advent of promoters in our midst—what you might call pocket editions of J. P. Morgan. These men, hearing of what Mr. Morgan or his firm got for financing the United States Steel Corporation, think the machinery business an excellent field for similar enterprise. They find a number of firms engaged in the manufacture of the same kind of machinery, and think the consolidation of them just the proper thing. They ask each of the firms what they want for their plant, and how much in cash and in stock of the sum asked they will take. Somebody hears of this and immediately the sale or absorption of this or that machinery business is announced, when, as a matter of fact, nothing occurs beyond what I have stated. Many such cases have come under my observation recently."

Word reaches us from Hartford, Conn., of unusual activity in manufacturing lines in that city affiliated with the iron and steel industry. A correspondent interviewed Philip Corbin, president of the American Hardware Company, and William H. Hart, president of the Stanley Works, on the outlook for business from the manufacturing standpoint. Mr. Corbin said the indications are very favorable to a continuation of the present activity for several months. Both the Corbin and Russell & Erwin concerns are running full time in all departments, and overtime in several rooms. The work on the immense new steel and brick addition to the Russell & Erwin factory will soon be well under way. This will give room for several hundred hands. As to the Stanley Works, President Hart said that every bench is occupied, and in order to fill the orders about 20 per cent. of the employees are and will continue for a long time on an all-night schedule. This overtime work is also the order at the company's hot-roller steel mill in Bridgewater, Mass., where 250 men are employed. The six new factory buildings, located on the west side of Curtis street and near the railroad, are nearing completion and will be ready for occupancy January 1. An immense new storage building is planned and will be erected in the spring. The Stanley Rule & Level Company will soon equip its large new factory with machinery. The 12-hour schedule in this concern will continue for an indefinite period. H. C. Noble, of the North & Judd Company, is now in the West, attending to some large orders. This concern has purchased considerable land, which will be held as sites for new buildings.

The mechanical draft feature of the Union Electric Light & Power Company's plant, which will be used for lighting the World's Fair Grounds at St. Louis, will be an installation of unusual interest to engineers. The plant is to be equipped with both forced and induced draft apparatus, which is unusual. A mechanical draft plant usually is either of the forced or induced draft type, but in this case both will be used. There will be twenty-six boilers of 700 horse-power each, and will be equipped with automatic stokers. Fans will be used for the forced draft, and the boilers will also be operated under induced draft. The forced draft fans will be four in number, of the full housing type, size 160 inches. They will be driven by 10x10 vertical engines direct attached. The induced draft fans will be two in number, of a size quite in keeping with the basis upon which the Exposition is to be built, the wheel diameters being so large as to be seldom met with in mechanical draft engineering. Each of these induced draft fans will be of the full housing type, size 230 inches, and will be driven by 9x10 double cylinder, double acting upright engines, this type being selected to secure the maximum power in limited space. The Buffalo Forge Company is building all the fans and engines for the above equipment.

The National Machinery Company, of Tiffin, Ohio, report that business in the bolt, nut and special machinery trade in the last thirty days has been exceedingly good. Judging from the orders on hand and the inquiries received, and considering the fact that this is the dull season of the year, the company look for a large volume of business for the first of the year. Rumors of decreasing trade are not substantiated, and the company's plant is running to its full capacity to take care of what in their opinion promises to be the largest year in their history. Foreign trade is picking up, and very substantial orders have been received from France and Germany.

The Sprague Electric Company is receiving many orders for its direct-current apparatus and reports among recent sales the following: Twenty 200-kilowatt turbine generators, three 75-kilowatt generators and four 20-kilowatt generators to the De Laval Steam Turbine Company, Trenton, N. J.; one 200-kilowatt belted-type and one 200-kilowatt engine-type generator to H. O. Wilbur, Philadelphia; one 200-kilowatt engine-type generator to the Otis Elevator Company, Yonkers; one 200-kilowatt belted-type generator to W. D. Ewart, Chicago; one 40-kilowatt and two 35-kilowatt belted-type generators to the Criterion Hotel, New York; one 75-kilowatt belted-type generator to C. Poyet, New York; one 50-kilowatt belted-type generator to the American Express Company, Chicago; two 3 horse-power round-type motors to the West End Theater, New York; eight 8-kilowatt generators, six 5 horse-power and four 1 horse-power motors to the Fisher Motor Vehicle Company, Hoboken, N. J.; one 40 horse-power medium-speed motor to J. F. Perkins Company, Brooklyn; one 15 horse-power S. S. type motor to L. W. Pond Machinery & Foundry Company, Worcester, Mass.; one 40 horse-power belted-type motor to Miehle Printing Press Manufacturing Company, Chicago; two 20 horse-power M. S. type motors to the Sigourney Tool Company, Hartford, Conn.; one 17 horse-power S. S. type motor to the Martinique Apartment House, New York; two electric hoists to the Phœnix Iron Works, Phœnixville, Pa.; one electric hoist to Landis Tool Company, Geiser Station, Pa.; one electric hoist to American Car & Foundry Company, Berwick, Pa.; one electric hoist to Scranton Supply & Machinery Company, Scranton, Pa., and one electric hoist to Pond Machinery & Tool Company, Plainfield, N. J.; two

electric hoists to Michigan Alkali Company, Wyandotte, Mich.

The J. W. Cregar Agency, The Bourse, Philadelphia, Pa., have taken the representation of the Kempsmith milling machine in the East. They have engaged additional space in their large exhibit in the Philadelphia Bourse, and will carry an exhibit of these milling machines, showing a full line of both plain and universal. The Cregar Agency will be the Eastern distributing point.

The S. Obermayer Company, of Cincinnati, Ohio, manufacturers of foundry supplies, have done a very large export trade recently, especially in South America, to which they recently made a large shipment of plumbago, foundry facings, and supplies. They are also in receipt of large orders from Tokyo, Japan; London, Hamburg, Mexico, Cuba, and Canada. The company's domestic trade is excellent.

William Schmidt, Jefferson City, Mo., has moved his machine shop to a new building, 308 Monroe street, and added to his equipment several pieces of the most improved modern machinery, among them a Landis universal grinder.

The district office managers of the Westinghouse Electric & Manufacturing Company, representing all the principal cities of the United States, have spent the past week in their usual annual visit to the works and offices of that company at East Pittsburg. On the evening of November 19 a very enjoyable dinner, in honor of the visitors, was given at the Duquesne Club, at which the engineers and executive officers of the company were also present.

The Vilter Manufacturing Company, builders of refrigerating and ice-making machinery, Corliss engines, brewers' and bottlers' machinery, Milwaukee, Wis., have recently closed contracts with the following parties: Schermerhorn-Shotwell Company, Des Moines, Iowa, one 20-ton refrigerating machine; Rock Island Brewing Company, Rock Island, Ill., 100-ton refrigerating machine; Cosmopolitan Hotel, New Orleans, La., 15-ton refrigerating and 3-ton ice plant; Standard Brewing Company, New Castle, Pa., 80-ton refrigerating machine; Pittsburgh Brewing Company, "Iron City Brewery," Pittsburgh, Pa., one duplex 350-ton refrigerating machine; Fred. Sehring Brewing Company, Joliet, Ill., two 50-ton refrigerating machines; Middle-West Brewing Company, Joplin, Mo., 60-ton refrigerating machine and 50-ton ice plant; New Kensington Brewing Company, New Kensington, Pa., 100-ton refrigerating and 25-ton ice plant; American Brewing Company, Bennett, Pa., one 100-ton refrigerating machine; Goenner & Co., Johnstown, Pa., 50-ton refrigerating machine (second order); American Candy Company, Milwaukee, Wis., 12-ton refrigerating machine; Oliver Chilled Plow Works, South Bend, Ind., two 13-ton rerigerating machines with 4-ton ice plant; Columbus Brewing Company, Columbus, Ohio, direct expansion ammonia piping; H. Annegers & Bro., Dayton, Ohio, one ammonia condenser. They have also received orders for Corliss engines from the following: Gutmann & Co., Chicago, Ill.; Wausau Paper Mills, Brokaw, Wis.; Louisiana Central Lumber Company, Clarks, La.; Wm. Henning Vinegar Works, Chicago, Ill.; Lamar Light & Water Company, Lamar, Mo.; City Water & Light Dept., Fort Atkinson, Wis.; Ewart Building, Chicago, Ill.; Warner Starch Company, Waukegan, Ill.; Hilgen Manufacturing Company, Cedarburg, Wis.; Rock Island Sash & Door Works, Rock Island, Ill.; American Candy Company, Milwaukee, Wis.; Boland & Gschwind Company, Ltd., New Orleans, La.

The Hartford Pattern and Model Company, of Hartford, Conn., pattern and model makers, formerly operated as a private company, recently became a corporation.

The plant of the Noble & Wood Machine Company, of Hoosick Falls, N. Y., which was destroyed by fire last March, has been completely rebuilt, and the company is now able to carry on its business of manufacturing paper mill machinery.

CHICAGO MACHINERY MARKET.

Conditions at the machine-tool factories are described by one representative here as less strenuous. There is less irritation, less inability to take care of the trade, demand and supply resuming normal relationships. This is referred to, from the standpoint of the representative, as a happy state of affairs, because now business can be conducted with less worry and with greater satisfaction for all interests concerned. Reports concerning the machine-tool trade in the West during November do not wholly agree, but are not extremely apart from each other. Several houses say trade keeps up very well, a majority report some decline in the aggregate, as compared with October and several preceding months. Quite a good trade is looked for during the first week of December, when all the Western railroads give half-fare rates to country merchants and manufacturers who wish to visit Chicago for the holiday trade. Because of this influence visits from the country have been fewer than usual for a week or two past.

November trade in machine tools has had few transactions of especial moment. In a general way, the railroad companies are frequently referred to as good buyers and some fairly good orders were placed by implement people, constituent companies of the International Harvester Company. The Western roads are using up their rolling stock much more rapidly than usual, because of the high pressure under which traffic is carried on. They are behind in shop work and the tool buying is by way of general helpfulness in making repairs and getting out new cars.

The cities of Chicago, Milwaukee, St. Paul and Minneapolis are alluded to as presenting a goodly percentage of the current orders, machine-shop improvements in those localities being of especial note. But it is probably invidious to make distinctions of this sort. One prominent machine-tool man says that shop improvements are being made rapidly throughout the West, and while some of the current business is equipment for additions and extensions, the more marked feature is the displacement of one machine tool by another, increasing the general efficiency of the plant.

No one complains that prices are not being maintained and the tone of the market may be described as excellent. Stocks are in pretty good shape, but are not complete, many tools going out from store as fast as they arrive from factory. The somewhat easier condition of the market during the past few weeks does not occasion any concern, for the undertone of the market is active, and inquiries are of such volume as implies brisk buying some time in the near future. Western shop owners are not yet satisfied with the character of their equipment, and if general trade continues up to recent standards it is believed there will be good buying of machine tools not later than early next year.

Quotations.

NEW YORK, Monday, December 1.

New York prices for Northern and Southern irons for the first half of 1903 are as follows:

Northern:	
No. 1 X	$23 25 @ $24 75
No. 2 X	22 00 @ 22 75
No. 2 plain	21 00 @ 21 75
Southern:	
No. 1 Foundry	23 25 @ 23 50
No. 2 Foundry	22 25 @ 22 50
No. 3 Foundry	21 50 @ 22 00
No. 4 Foundry	20 50 @ 21 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11½ @ 11⅝c.; electrolytic and casting, 11¼ @ 11⅜c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 25⅛ @ 25¼c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5.15 @ 5.25c.

Antimony—Cookson's, 9 @ 9½c.; Hallett's and U. S., 7¼ @ 7½c.

Lard Oil—Prime City, 88 @ 90c., according to brand and quantity, ranging from one barrel up to large lots.

Manufacturers.

A brew house is about to be built for Theodore Finkenauer, Philadelphia.

The Pacific Steel & Wire Company is erecting a plant in East Oakland, Cal.

Thomas H. Wade, Huntsville, Ala., will establish an excelsior factory there.

The Diamond Match Company is improving its plant at Charlestown, N. H.

Two of the Niles (Mich.) Board & Paper Company's mills have been burned.

M. I. Barker and son, R. M. Barker, will erect a large canning factory in Carrollton, Ky.

It is reported from Buffalo, N. Y., that the plant of the Niagara Desk Company has been burned.

J. B. Masson & Co., mirror manufacturers, Louisville, Ky., will erect a new building in the spring.

An erecting shop is about to be built for Steel & Wike, engineers and contractors, Philadelphia.

Griggs, Cooper & Co., St. Paul, Minn., propose to build a large packing and food manufacturing plant.

A large packing plant at Sioux City, Ia., of Armour & Co., Chicago, has been burned. It will be rebuilt.

The Sherwin-Williams Company, of Cleveland, O., intends to erect a new paint plant at Montreal, Que.

A four-story, 66x512-foot factory building will be erected in Philadelphia for the American Lace Company.

The Grand Rapids (Mich.) Piano Case Company will build a factory with 42,000 square feet of floor space.

Fire at Rockland, Me., has burned the cooper shop and boiler-house of the Rockland-Rockport Lime Company.

The Johns-Pratt Company, Hartford, Conn., manufacturer of asbestos goods, etc., plans the enlargement of its plant.

The New Process Manufacturing Company, car roofing, etc., St. Louis, Mo., and elsewhere, is about erecting a new factory.

The White Lily Washer Company has been organized to build a factory in Davenport, Ia., to make washing machines.

The Excelsior Tool & Machine Works, St. Louis, Mo., is about starting building operations estimated to cost $29,000.

An addition is being built to the establishment of the H. W. Butterworth & Sons Company, machinists, Philadelphia.

The contract has been let for erecting a factory building for the Mason Washer Company, organized at Oxford, Md.

Plans have been made for a factory for John E. Lonergan, Philadelphia. John E. Lonergan & Co. are brass founders, etc.

An extension, 50x106 feet, will be built in Philadelphia at the Bement, Miles & Co. plant of the Niles-Bement-Pond Company.

C. A. Bisler, of Philadelphia, has been visiting Dover and other towns in Delaware, looking for a site for a strawboard factory.

B. Souto & Co., 161 Front street, New York city, have let the contract for building their new furniture manufacturing plant at Brattleboro, Vt.

The Merrell-Soule Company, manufacturer of mince meats and canned goods, Syracuse, N. Y., will, it is said, build a $100,000 factory near there.

Plans have been made for a plant at Coplay, Pa., for the Coplay Cement Manufacturing Company. The engine-house will be 50x79½ feet.

A beet sugar plant is to be built at Longmont, Colo. Neil P. Sullivan is president of the company that is being formed, and J. B. Thompson, secretary.

It is understood that the Barber Asphalt Paving Company, of New York, will erect at Fort Dodge, Ia., a plant to contain $50,000 worth of machinery.

G. Nicke and Louis Schmurkert, of Chicago, and C. Schlagel, of Tomah, Wis., are making arrangements to start a peat plant in the vicinity of Tomah.

The United States Reduction & Refining Company, Colorado City, Colo., will erect a $100,000 addition for the manufacture of chlorin gas by electricity.

A factory to employ about 100 men is to be established in Milan, Mich., by a stock company, to manufacture a computing scale invented by Walter F. Stimpson.

The E. Jenckes Manufacturing Company, manufacturer of knitting machinery, etc., Pawtucket, R. I., has broken ground for a 200x64-foot, three-story building.

The Ogilvie Flour Mill Company, Montreal, Que., will erect in Fort William a flour mill with a capacity of 1,500 barrels in twenty-four hours, and a 500,000-bushel elevator.

It is believed that a large plant to be erected on the Pacific Coast by the Diamond Match Company will be located in Butte County, Cal. A pulp mill will be included.

The factory of the Bloch Bros. Tobacco Company, Wheeling, W. Va., is to be increased to about double its present size. There will be an electric power and lighting plant in it.

The Acme Mills Company, Hopkinsville, Ky., has changed its name to the Acme Mills & Elevator Company, increasing its capital stock from $100,000 to $200,000. The plant is to be enlarged.

The J. S. Kemp Manufacturing Company, Newark Valley, N. Y., manufacturers of manure spreaders, contemplates locating a factory in Waterloo, Ia., to have at least 50,000 square feet of floor space.

A charter has been granted to the Williamsburg Paper Manufacturing Company, of Williamsburg, Pa., with a capital stock of $250,000. It is proposed to build a plant. Water rights have been secured.

The Planett Manufacturing Company, Chicago, manufacturer of picture frames, will, it is understood, move its plant to Laporte, Ind., where 300 men will be employed by the company and a smaller industry which will come with it.

It is stated that the Barry Foundry Company has awarded contracts for erecting buildings in Muscatine, Ia. This may refer to the Barry Manufacturing Company, of that place, manufacturer of plumbers' supplies and button machinery.

The Wilmington (Del.) Malleable Iron Company has bought a site for a large new plant. There is an unconfirmed rumor that the company's old plant has been bought by the Hilles & Jones Company, manufacturer of metal-working machinery.

The Mauser Manufacturing Company, 14 East Fifteenth street, New York, silversmith, thinks of erecting a large new factory. An option has been obtained on land in Mount Vernon, a neighboring town, but a site in New York may be chosen.

Mayor Hanan, of Niagara Falls, Ont., is in receipt of a communication from the Farmers' Co-operative Machinery Company, capitalized at $1,000,000, inquiring as to the conditions in that town for a plant to manufacture agricultural implements.

The Agar Packing Company, Chicago, Ill., and Des Moines, Ia., proposes to increase its stock by $200,000. The new capital is to be used in enlarging the Des Moines plant and extending the company's business.

The Nordberg Manufacturing Company, builder of machinery, Milwaukee, Wis., has begun work on an additional shop, 100x220 feet, at its new plant. The company is said to have on hand orders sufficient to keep it busy night and day for two years.

The Narrow Fabric Corporation has awarded to Tracy Brothers, of Waterbury, Conn., a contract for the erection of a factory in West Haven, to be 102x205 feet. A boiler and engine house will also be erected, and the plant will be equipped with electric power.

The Rosedale Foundry & Machine Company, of Allegheny, Pa., a consolidation of the Rosedale Foundry and the Specialty Manufacturing company, has completed plans for a new foundry and machine shop, 432x90 feet, and a power plant, 60x32 feet.

H. H. Cohen, of Cleveland, O.; W. T. Gayle, of Washington, D. C., and F. S. Keith, of Corona, N. Y., have been at Rogers City, Mich., recently testing marl and other materials used in making Portland cement. They represent Eastern capitalists who have, it is said, formed a company capitalized at $3,500,000 and will erect buildings at or near Rogers City.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Grant. Gears. See upper corner, page 72.

See the Lowe test indicator, page 128.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Stamping Dies. Emmons Collins, Chicago.

Order your new or special machines from the Industrial Mach. Co., Newark, N. J.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Working drawings for special machinery, patent articles, etc. Geo. M. Mayer, M. E., Monadnock, Chicago.

First-class designing, drafting and tracing done to order. Address "Experienced Designer," care AMERICAN MACHINIST.

The Wellman Sole Cutting Machine Co., of Medford, Mass., designs and builds light machinery. Correspondence solicited.

An experienced engineer will perfect, simplify or improve upon articles of manufacture. Address Box 236, AMERICAN MACHINIST.

Wanted—An interest in a hardware, mill supply, machinery or belting business in New York city. Address "Cash, care AM. MACH.

Wire pointing machinery, from ½ in. downwards; address of maker wanted. Godrich, Wharf street, Aston, Birmingham, Eng.

Oil Engines.—Book by Goldingham; valuable for designers, builders, users of oil or gas engines; postpaid for $2. Spon & Chamberlain, 123 Liberty, New York.

Wanted—Light machine work and special machinery to build to order, special tools, die and punches; a well-equipped water-power plant and first-class workmen. The Bantam Mfg. Co., Bantam, Conn.

Wanted—Machinist, with from $1,000 to $2,000, to take an interest in and the superintendency of a concern manufacturing laundry machinery in Chicago. Address C. T. Cummins, 210 Larrabee st., Chicago, Ill.

Wanted—A large contract to build medium or light automatic machinery; we have the plant, the experience, the capital; cam cutting a specialty; we make the best adjustable reamers. Ott. Mergenthaler Company, Baltimore, Md.

Liberal commission to machinery salesmen able to handle, as a side line, machines suitable for use by railroads, machine shops, saw and planing mills and by all manufacturers of wood and metal. Address Box 241, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in

Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

A money-making metal working and stamping plant for sale; orders easy to get and at good prices; good specialties and ready customers for them; capable of great expansion, and profits will pay at a rapid rate for all additions and improvements; special reasons for selling; price $25,000. Address Box 232, AMERICAN MACHINIST.

Co-operation of a machine shop-firm to manufacture a kerosene oil internal combustion engine of undoubted merits and now in operation; the market is wide open; you do the building and we the selling; very small capital required. You deal with well-known business men when you address G. K., Box 283, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Machine designer, etc., wants position. Address Box 63, AMERICAN MACHINIST.

As foreman, by A1, progressive pattern-maker. K. G., care AMERICAN MACHINIST.

Mechanical draftsman, designing, able, is seeking position. Box 286, AMER. MACHINIST.

Mechanical draftsman, Swede, graduated, 3 years' experience, wants position. Box 288, AMERICAN MACHINIST.

Experienced mechanical draftsman, technical graduate, wants to change. Box 250, AMERICAN MACHINIST.

Foreman and superintendent, 20 years' experience, open for engagement; die work preferred; best references. Box 271, AM. M.

Manufacturing engineer; labor-saving methods; special tools, jigs, etc.; correspondence solicited. Eugene Wilson, care AM. MACH.

Mechanical draftsman, experienced on machinery, mill work, furnaces, etc., wishes position near New York. Box 258, AM. MACH.

Mechanical draftsman, graduate, 3½ years' experience in shop and drawing room, best references, desires position. Box 289, AM. M.

Designing draftsman, technical graduate, 10 years' shop and drawing-room experience, wishes to change position. "Designer," care AMERICAN MACHINIST.

First-class mechanical draftsman, technical graduate, with shop experience, wants situation; New York preferred. Box 274, AMERICAN MACHINIST.

A machinist of wide experience as a toolmaker and foreman is looking for a position as shop superintendent or foreman. Address Box 285, AMERICAN MACHINIST.

Position as assistant superintendent or foreman, by a young engineer who has had experience in similar positions; best of reference. Box 268, AMERICAN MACHINIST.

Wanted—Position as superintendent or general foreman of a machine shop; accurate heavy work preferred; 40 years old; first-class reference. Box 269, AMER. MACH.

General foreman, responsible man, age 34, experienced in high-class automatic and interchangeable machinery, wishes to make change about January 1. Box 287, AMER. MACH.

Mechanical draftsman wants position; first-class designer on tools, dies, jigs and fixtures; 20 years' experience in drafting and shop work; good reference. Box 280, AM. MACH.

Mechanical engineer, expert on gasoline motors and automobiles, graduated in Germany, inventive ability, desires position as chief draftsman or superintendent. Box 284, A. M.

Superintendent machine tool plant, experienced designer machine tools and special automatic machinery, with office and selling experience, is open to change. Address Box 276, AMERICAN MACHINIST.

Expert on automatic machinery, light and heavy; first-class designer; inventive ability; 10 years' best experience; graduate; fitted for head draftsman, superintendent or to develop inventions; terms moderate. Box 257, A. M.

Mechanical engineer, 13 years' shop and drawing-room experience, familiar with machine tools, cranes, hydraulic and structural work, wants position as chief draftsman or assistant superintendent. Box 251, AM. M.

Salesman or representative open for engagement; technical graduate (29); 10 years' shop, drawing-room and commercial experience; machine tools and general engineering; excellent references; New York preferred. Box 275, AMERICAN MACHINIST.

Help Wanted.

Draftsmen for designing tools and gages for rifle work. Address Box 281, AM. MACH.

Wanted—Good tool and die maker on bicycle work. Address Day Mfg. Co., Lakeview, N. Y.

Machinist and toolmaker; give age, experience, etc. Wilson Laundry Mach'y Co., Columbia, Pa.

Wanted—First-class machinists, bench hands and men accustomed to running turret lathe. Marvin & Casler, Canastota, N. Y.

Wanted—Two good wood patternmakers, experienced on pumps and hydraulic work. The Goulds Mfg. Co., Seneca Falls, N. Y.

Wanted—First-class machinists, in city near Philadelphia; steady work and good pay. The Reeves Engine Co., Trenton, N. J.

Wanted—Machinists and draftsmen to send postal for free set tables of lathe gearing and valuable formulas and tests. Box 290, A. M.

Machinists, send 5 cents for blueprint table of U. S. standard steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—A first-class patternmaker, accustomed to medium-sized work. Apply, stating age, experience and wages expected, Box 244, AMERICAN MACHINIST.

Wanted—Electrical engineer to run gas engine and electric light plant. Apply, stating experience and salary expected, to C. J. Goodnough, secy., Emporium, Pa.

Wanted—Assistant superintendent on manufacture of interchangeable work in ship fittings and in mechanical and electrical work. Box 279, AMERICAN MACHINIST.

Wanted—Positions for experienced men, and men for such positions. Address James Brady (late Brady Mfg. Co.), Room J, 20th Floor, 220 Broadway, New York.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—Draftsman who has had practical experience in the shop, capable of acting as assistant designer for a firm building boring mills, planers, etc. Box 255, AM. MACH.

Wanted—First-class machinist foreman; must be familiar with gas engine construction; good position in a growing concern in the Middle West. Box 270, AMER. MACH.

Wanted—Two good, all-round machinists, accustomed to building automatic machinery. Address, stating age, experience and wages expected, Box 245, AMERICAN MACHINIST.

Wanted—A man who is accustomed to hardening and tempering all kinds of tools; steady work; give references and experience; confidential. Box 272, AMERICAN MACHINIST.

Wanted—Assistant engineer on design and manufacture of interchangeable work in ship fittings, mechanical and electrical work, and in erection and test of same. Box 278, A. M.

Wanted—A first-class mechanical draftsman; must be experienced in light interchangeable machinery. Address, stating age, experience and salary expected, P. O. Box 1513, New York City.

Several good designers, draftsmen and tracers required on ship fittings, mechanical and electrical machinery; interchangeable work; permanent position and good pay to the best men only. Box 277, AM. MACH.

Wanted—At once, a first-class draftsman; one accustomed to a general run of machine work and capable of doing his own thinking and designing; a good position to the right man. Address Box 247, AMER. MACHINIST.

Wanted—Experienced mechanical draftsman; New England; experience on paper-making machinery and mill work requisite; state age, education, experience, with whom, and salary required. Box 263, AMER. MACH.

Wanted—For Detroit suburb, first-class machinists and diemakers on press and die work, also good, all-around blacksmith on die and tool forgings; permanent positions to reliable men. Address Michigan Manufacturing Co., Ypsilanti, Michigan.

We are constantly increasing the scope of our work, and invite applications for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Toolmakers on small, intricate fixtures, capable of giving good fits and making perfect alignments; must be able to give good references as to quickness and accuracy; such men are requested to state age and wages expected. Address Dental Mfg. Co., Prince Bay, N. Y.

James Brady, member American Society Mechanical Engineers, former owner of Brady Mfg. Co., consulting engineer and appraiser, particular attention given to economy in manufacture, can furnish good men for heads of departments in the metal-working industry. Room J, 20th floor, 220 Broadway, New York.

Wanted—An experienced mechanic; one able to operate automatic machinery, design and build labor-saving machinery and to take charge of repair work in a nut and bolt plant; prefer young man with experience in this line; state age, experience and wages wanted by the month. Address Box 273, AM. M.

A manufacturing company 50 miles from Chicago wants three good machinists for steady, light work at construction and repairs of weaving machinery; quality of work is good and accuracy is required. Address, stating full particulars of experience, etc., Western Cane Seating Company, Michigan City, Ind.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

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National Machy. Co., Tiffin, O.

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Stillwell Mfg. & Steam Specialty Co., Philadelphia, Pa.

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Christensen Engineering Co., Milwaukee, Wis.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Uniform Steel Co., Rahway, N. J.

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Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
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Hoggson & Pettis Mfg. Co., New Haven, Conn.
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Whiton Mach. Co., D. E., New London, Conn.

Chucks, Scroll
Whiton Mach. Co., D. E., New London, Conn.

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Faneuil Watch Tool Co., Boston, Mass.
Hardinge Bros., Chicago, Ill.

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Nanz & Co., New York.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
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Thompson, Hugh L., Waterbury, Conn.

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Long & Allstatter Co., Hamilton, Ohio.

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Cost Keeping System
Rogers, W. S., Keene, N. H.

Countershafts
Builders' Iron Fdry., Provi., R. I.
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Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

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Byram & Co., Detroit, Mich.
Northern Engr. Works, Detroit, Mich.
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Paxson Co., J. W., Phila., Pa.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Montgomery & Co., New York.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

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Pratt & Whitney Co., Hartford, Conn.
Western Mfg. Co., Springfield, O.

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Dickinson, Thos. L., New York.

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Bliss Co., E. W., Brooklyn, N. Y.
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Errington, F. A., New York.
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Alteneder & Son, Theo., Phila., Pa.
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Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Aurora Tool Works, Aurora, Ind.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester, Mass.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

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Baker Bros., Toledo, O.
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Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
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Niles Tool Works Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.

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Columbus Pneumatic Tool Co., Columbus, O.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
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Bickford Drill & Tool Co., Cincinnati, Ohio.
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Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reade Mchry. Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
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Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reed Co., Francis, Worcester, Mass.
Sibley & Ware, South Bend, Ind.
Washburn Shops, Worcester, Mass.

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Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

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Pratt & Whitney Co., Hartford, Conn.

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Emery Wheel Dresser
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Mietz, August, New York.
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Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Springfield Gas Eng. Co., Springfield, O.
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Struthers-Wells Co., Warren, Pa.

Engines, Steam
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Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.

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Consolidated Engine Stop Co., New York.

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Buffalo Forge Co., Buffalo, N. Y.

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Burt Mfg. Co., Akron, O.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

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Montgomery & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Works, Troy, N. Y.

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Kinsey-Burt Mfg. Co., New York.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, Ohio.

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Lunkenheimer Co., Cincinnati, O.
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Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N. Y.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester Mass.

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Byram & Co., Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Smith Fdry. & Supply Co., J. D., Cleveland, O.
Whiting Foundry Equip. Co., Harvey, Ill.

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Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.
Westmacott Co., J. M., Providence, R. I.

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New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Furnaces
Am. Gas Furnace Co., N. Y. City.
Westmacott Co., J. M., Providence, R. I.

Gear Cutting Machinery
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Saunders Mfg. Co., Dayton, O.
Walcott & Son, Geo. D., Jackson, Mich.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Gear Wks., Cleveland, O

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Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
Messmer & Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Wks., Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Walcott & Son, Geo. D., Jackson, Mich.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. Y.
Lubriphite Co., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Hisey-Wolf Mach. Co., Cincin., O.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford Conn.
Rivett-Dock Co., Boston, Mass.
Russell, R. M., Binghamton, N. Y.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Blount & Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Falkenau-Sinclair Co., Phila., Pa.
Frasse Co., New York.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Hisey-Wolf Mach. Co., Cin., O.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co. Chicago, Ill.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Russell, R. M., Binghamton, N. Y.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Washburn Shops, Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Montgomery & Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Frasse Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
Olmsted, L. H., Hasbrouck Heights, N. J.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Iroquois Machine Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.
Williams, White & Co., Moline, Ill

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Power
Scranton & Co., The, New Haven, Conn.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburg Shear Knife & Mach Co., Pittsburg, Pa.

Handles, Machine
Norwood Mach. & Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
American Blower Co., Detroit Mich.
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.
Woodman Mfg. & Supply Co., R., Boston, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Rue Mfg. Co., Philadelphia, Pa.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Wallace Supply Co., Chicago, Ill.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo O.
Bement, Miles & Co., New York.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Hill Tool Co., Anderson, Ind.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathes
American Tool Wks. Co., Cin., O.
Auto. Mach. Co., Bridgeport, Ct.
Automatic Mach. Co., Greenfield, Mass.
Barker & Co., Wm., Cincinnati, O.

Lathes—*Continued*
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Blount & Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Prov., R. I.
Falkenau-Sinclair Co., Phila., Pa.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Frasse Co., New York.
Garvin Mach. Co., New York.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry Co., Chicago, Ill.
Montgomery & Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Tanite Co., Stroudsburg, Pa.
Walcott & Son, Geo. D., Jackson, Mich.
Washburn Shops, Worcester, Mass.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Eddystone Engineering Co., Eddystone, Pa.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Fenn-Sadler Mch. Co., Hartford, Conn.
Hardinge Bros., Chicago, Ill.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Wood
American Machinery Co., Grand Rapids, Mich.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Mass. Tool Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.
Narragansett Mach. Co., Providence, R. I.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.
Lubriphite Co., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lubriphite Co., Jersey City, N. J.
Lunkenheimer Co., Cincinnati, O.

Lumber, Patternmakers'
Johnson Lumber Co., Milwaukee, Wis.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Atlas Foundry & Mch. Co., Belleville, N. J.
Blanchard Mach. Co., The, Boston, Mass.
Fawcus Mch. Co., Pittsburgh, Pa.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Lowe, H. A., Waltham, Mass.
Mass. Tool Co., Greenfield, Mass.
McCrosky & Huber, Cincinnati, O.
Montgomery & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mch. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., New Haven, Conn.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
American Foundry & Mach. Co., Hanover, Pa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Christensen Engr. Co., Milwaukee, Wis.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N.J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. Co., Chicago, Ill.
Sprague Electric Co., New York.
Stow Mfg. Co., Binghamton, N. Y.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Nail Machinery, Wire
National Machy. Co., Tiffin, O.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
G. & P. Engraving Co., Boston, Mass.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Oil Cans, Pump
Wallace Supply Co., Chicago, Ill.

Oil Cups and Covers
Bay State Stamping Works, Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Packing, Steam Joint
Jenkins Bros., New York.

Painting Machines
Hook, F. E., Hudson, Mich.

Paints
Hook, F. E., Hudson, Mich.
Wallace Supply Co., Chicago, Ill.

Pans, Lathe
New Britain Mch. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Patternmakers' Lumber
Johnson Lumber Co., Milwaukee, Wis.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Greaves, Klusman & Co., Cin., O.
Machinery Exchange, Chicago, Ill.
Prentiss Tool & Supply Co., New York.
Washburn Shops, Worcester, Mass.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.
Olmstead Co., H. B., New York.

Pencils
Keuffel & Esser Co., New York.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
American Tool Wks. Co., Cin., O.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Bench
Bartlett, E. E., Boston, Mass.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Presses, Hand
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Perkins Mach. Co., So. Boston, Mass.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Falkenau-Sinclair Co., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.
Saunders Mfg. Co., Dayton, O.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pulleys, Speed Changing
Speed Changing Pulley Co., Indianapolis, Ind.

Pumps, Hydraulic
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Walcott & Son, Geo. D., Jackson, Mich.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Montgomery & Co., New York.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.

Rods and Straps, Connecting
Standard Connecting Rod Co., Beaver Falls, Pa.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Roller and Ball Bearings
American Roller Bearing Co., Philadelphia, Pa.
Ball Bearing Co., Philadel., Pa.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rules, Steel
Mass. Tool Co., Greenfield, Mass.
Sawyer Tool Co., Fitchburg, Mass.
Starrett Co., L. S., Athol, Mass.

Safety Valves, Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sand Blast Apparatus
Paxson Co., J. W., Philadel., Pa.

Sand Mixing Machines
Smith Foundry Supply Co., J. D., Cleveland, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Cochrane-Bly Mach. Works, Rochester, N. Y.
Marston & Co., J. M., Boston, Mass.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.
West Haven Mfg. Co., New Haven, Conn.

Sawing Machines, Wood
American Machinery Co., Grand Rapids, Mich.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.
Railway Educational Association, Brooklyn, N. Y.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Affleck, Geo. E., New York.
Baird Machy. Co., Pittsburg, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegheny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wickes Bros., New York.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Separators, Oil
Springfield Separator Co., Manchester, N. H.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Barker & Co., Wm., Cincin., O.
Bement, Miles & Co., New York.
Blount & Co., J. G., Everett, Mass.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mch. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Perkins Mach. Co., Boston, Mass.
Potter & Johnston Mach. Co., Pawtucket, R. I.

Shapers—*Continued*
Smith & Mills, Cincinnati, Ohio.
Steptoe & Co., John, Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.

Shapers, Vertical Die
Rochester Die Shaper Co., Rochester, N. Y.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works, Cleveland, O.
Falkenau-Sinclair Co., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
National Mchry. Co., Tiffin, O.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Perkins Mach. Co., Boston, Mass.
Reade Mchry Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Perkins Mach. Co., So. Boston, Mass.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett, E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Wilmington, Del.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Spike Machines
National Machy. Co., Tiffin, O.

Springs
Dunbar Bros., Bristol, Conn.

Sprocket Chains
See Driving Chains.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Stamps, Steel
The Chandler Co., Springfield, Mass.
Schwerdtle Stamp Co., Bridgeport, Conn.

Steel, Machinery
Boker & Co., Hermann, New York.
Patriache & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Boker & Co., Hermann, New York.
Patriarche & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., New Haven, Conn.
National Mchry. Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps, Collapsing
Geometric Drill Co., New Haven, Conn.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Geometric Drill Co., New Haven, Conn.
Hammacher, Schlemmer & Co., New York.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Mchry. Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Winter Bros. Co., Wrentham, Mass.

Telephone System
Clark Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
McCrosky & Huber, Cincinnati, O.
O. K. Tool Holder Co., Shelton, Conn.
Western Mfg. Co., Springfield, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Reeves Pulley Co., Columbus, Ind.
Saunders Mfg. Co., Dayton, O.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Washburn Shops, Worcester, Mass.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Tubing, Steel
Shelby Steel Tube Co., Pittsburg, Pa.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Emmert Mfg. Co., Waynesboro, Pa.
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Washer Machines
National Machy. Co., Tiffin, O.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Whitewashing Machines
Hook, F. E., Hudson, Mich.
Wallace Supply Co., Chicago, Ill.

Wire-Drawing Machinery
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.

Wood Working Machinery
American Machinery Co., Grand Rapids, Mich.

Worm Hobbing Machines
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Automatic Mach. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.

A Large Horizontal Boring, Drilling and Milling Machine.

BY A. L. DE LEEUW.

The machine illustrated is a horizontal boring, drilling and milling machine of the heaviest type. This class of machine might be called a machine shop in itself, as it is available for a great variety of work, which cannot be reached by any other single tool. It is capable of doing all the necessary operations on many heavy castings and forgings, and is equally well adapted for drilling and reaming small holes (the machine having high enough speeds for 1½-inch holes), as for boring and facing, say, large cylinders of 60 inches diameter, or even more, and of milling bed castings, flywheel sections, etc.

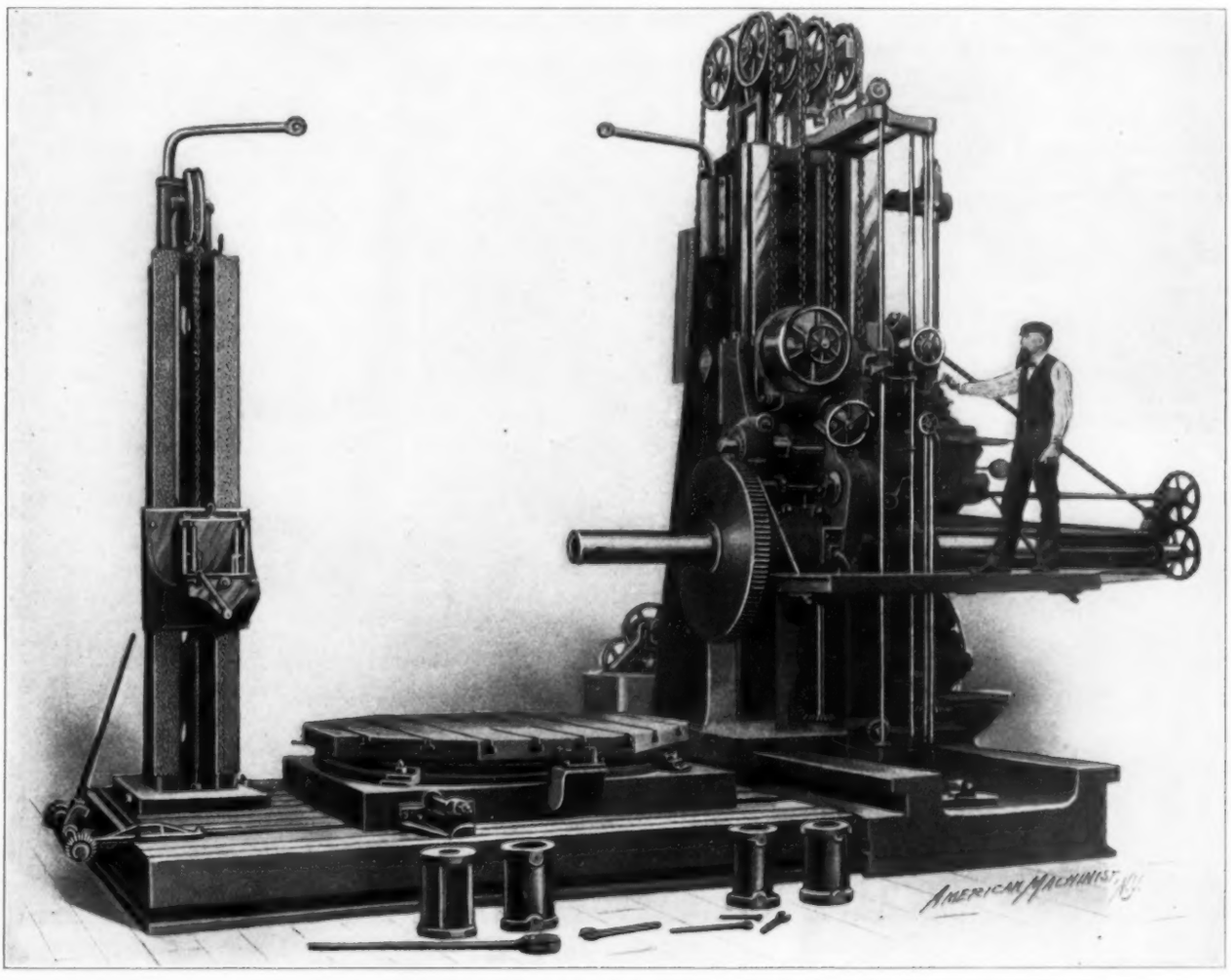


FIG. I. LARGE HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

It consists of a column traveling over a bed or sole plate and carrying a saddle which moves up and down over the column. This saddle holds the rotating spindle, which can feed in and out. Saddle and column both have a quick traverse by power in either direction as well as a great number of feeds.

The travel of the column on the bed is 12 feet.

The travel of the saddle on the column is 8 feet.

The travel of the spindle is 6 feet.

This spindle is of steel and 9½ inches diameter. It is provided with a taper hole at the front end, and is driven by means of a sleeve. The wear of the spindle in the sleeve is taken up by a taper bushing at the front end. This spindle sleeve may be driven in two ways, either by the face-plate gear (see Fig. 1) or by a smaller gear, not visible in the cut, as it is hidden by a gear shield. The face-plate gear is arranged so that boring bars or large milling cutters can be bolted to its front surface. The spindle feed is effected by means of a quick pitch screw. The feed is not taken direct from the spindle, but from one of the driving shafts. As this driving shaft has two different speeds in relation to the spindle (depending on which drive is used) it follows that the feed would be coarse, when the face-plate gear is used, and fine when the other drive is employed. For this reason two sets of feeds are also used, corresponding to the two speeds of the spindle. When I speak of *two* speeds, I mean the two sets of speeds obtained by changing from face-plate drive to sleeve gear drive. Each of the sets of feeds is amply large for all requirements.

The drive is by means of a variable-speed motor with a speed range of 2:1. The variation is obtained by field control. The field rheostat, the starting box and a solenoid operated switch are carried on top of the column. They are not seen in the cut, as the machine was photographed before these parts were in place.

Starting box and field rheostat are operated by means of chains hanging down and in easy reach of the operator. It was not thought advisable to carry an ordinary switch on top of the column, as the operator sometimes wants to stop right quickly, without wanting to waste time in hunting for an elusive chain. For this reason an ordinary knife switch was placed on the saddle, and, by means of flexible cord, connected to the large solenoid operated switch on top of the column. Thus no heavy currents are carried by the flexible cord, and yet the operator has the switch within his reach.

A set of sliding gears, and back gears, in combination with the various motor speeds, and the two different spindle drives, give a continuity of speeds from 1 to 50 revolutions per minute.

The motor seen in Fig. 2 is not the motor used in this machine. The motor

used had a somewhat larger foot, which interfered with a small column used for carrying the counterweight for the tail end of the saddle. This column and counterweight, therefore, had to be left off when the machine was photographed.

From the rear of the column the drive is taken to the rear of the saddle, by means of a very heavy vertical shaft, plainly visible in both illustrations. Referring to Fig. 2, it will be seen that this shaft drives a shaft in the saddle by means of three bevel gears which are so arranged that the throwing in of a clutch, one way or the other, reverses the motion of the spindle. This clutch slides on a sleeve, which in its turn slides on the shaft, thus relieving the clutch from all strains due to the feed motion up or down of the saddle. The clutch sleeve, as well as all screws and fast-running shafts, have ball-thrust bearings.

The feed, as well as the drive, has a reverse motion, so that it is possible to feed the spindle in or out, in whatever its rotation may be. The feed is by means of a set of large friction disks. The adjustment of these disks, the change from coarse to find feed (according to the drive) and the reversal of the feed are all accomplished by handles or hand wheels within easy reach of the operator. This is not only true of the spindle feeds, but also of the feeds for both column and saddle, and for the quick traverse of these latter two.

The saddle and all its parts are counterweighted, the counterweight running on the back of the column. This counterweight is supported by two chains, while two other and heavier chains are provided for safety. These latter chains are kept slightly slack, so as not to subject them to any strain, thus allowing them to retain their full strength for emergency cases. I mentioned before that there is another counterweight, not shown in the cut, balancing the tail end of the spindle.

Fig. 2 is a rear view of the column base, showing the drive and also feed and traversing mechanism for column and saddle. The feed is again taken from a set of friction disks. Means for quickly changing the feed from fine to coarse, and also for reversing its direction, are again provided. The quick traverse is taken from the slightly slanting shaft which may be noticed. This shaft drives a friction clutch. A second friction clutch, running on the same shaft as the first is driven by the feed mechanism. By throwing the clutch cone one way or the other, either of the friction clutches may be engaged, and in this way either a feed or quick traverse of column or saddle may be had by the movement of one lever. All changes of the feed are manipulated from the platform hung from the saddle. Even the adjustment of the friction disks, on the rear of the column, is operated from this platform. This platform, by the way, is provided with a hand rail, though the cut does not show one.

Attached to the bed of the machine is a floor plate carrying a square table base, upon which turns an octagon table. The turning of this table is accomplished by worm and worm wheel. The circular lower end of this table is graduated in degrees reading both ways. The octagon table is provided with four stops in quadrature. These stops can be brought into contact with a test indicator reading in .001 inch, thus insuring the absolute squareness of the piece being milled on this machine. The octagon table and its base are moved by two screws operated by a ratchet lever.

In addition to this octagon table an outboard column is carried by the floor plate. This outboard column is provided with a saddle sliding up and down, and a bearing on the saddle which has a motion in and out. This makes it possible to get the center of this bearing absolutely in line with the center of the spindle. The saddle, as may be seen in Fig. 1, is counterweighted. The column

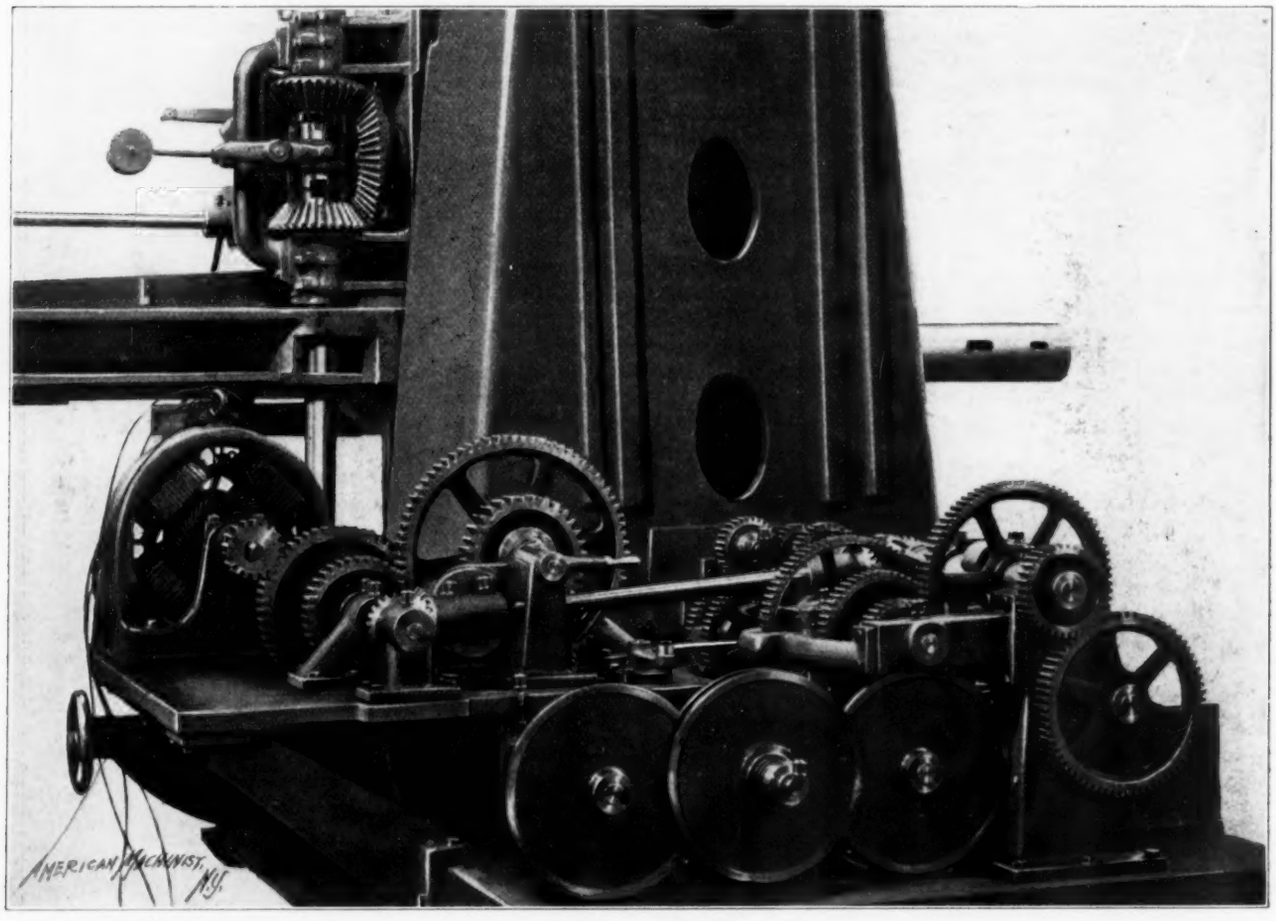


FIG. 2. REAR VIEW OF COLUMN BASE.

is set square by a tongue at the bottom fitted into T-slots of the floor plate.

Scales are provided on the bed and column, and also on the saddle carrying the outboard bearing; thus enabling the operator to set the spindle in any desired position without measuring. In addition to these scales, a portable scale is provided, fitted with a tongue in the T-slots of the floor plate. This scale allows the outboard column to be set with precision without depending on the absolute accuracy of the distances between the T-slots of the floor-plate.

As the entire drive—in fact, all the mechanism—is carried by the column, no shafts are needed in the bed, and it is therefore possible to make this bed of any length without subjecting long shafts to heavy strains, which generally limits the length of a bed.

Automatic stops are provided for both column and saddle travel, as further precaution for the accurate handling of this machine.

All levers are constructed in such a way that the movement of the lever is an indication of the movement of the machine; thus, in order to make the column travel forward, a lever is to be pulled forward; in order to make it travel backward, this same lever is pushed backward; in order to make the saddle go up, a second lever is to be raised up; in order to make the saddle go down, this same lever is pulled down, etc.

The following figures will give some idea of the immense size of this machine:

Bearing of the column on the bed—6 feet wide, 10 feet long.

Bearing of the saddle on the column—4 feet wide, 6 feet long.

Length of bed—21 feet for 12-foot travel.

The above machine was designed and built by the Niles Tool Works Company, of Hamilton, Ohio, for the Fraser & Chalmers works of Allis-Chalmers Company, of Chicago, Ill.

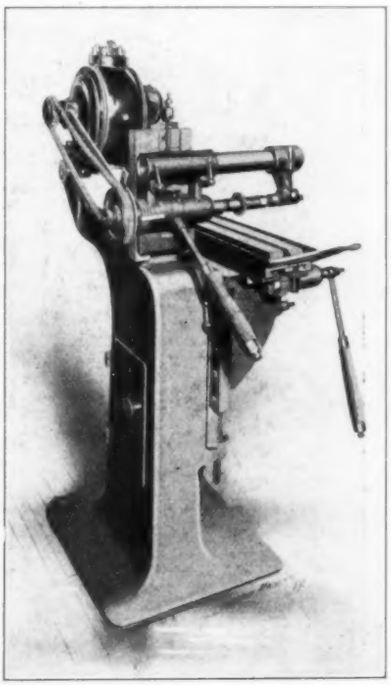
Chain Drive For Hand Milling Machine.

When a system of separate motor drives is to be installed in a factory, the question of transmitting mechanism does not always receive the thought and attention which its importance justifies. As a result, in such cases only a part of the increased efficiency possible under the separately driven machine-unit system is realized.

As is well known to our readers, in many instances where the various methods available have been critically compared the Renold silent chain, which is made in this country by the Link-Belt Engineering Company, of Nicetown, Philadelphia, Pa., is employed for connecting the motor to the machine with most satisfactory results.

As the chain cannot slip, the efficiency of the drive, especially where center distances are short, is above that obtained when belting is used and tests have shown that the motor takes less current when connected by the chain than when connected with spur gearing, owing to the fact that the former runs with a minimum amount of friction. In addition to these advantages, great economy in shop room is effected. As a long center distance is not required, the motor can be attached where most convenient.

The accompanying half-tone illustrates the compactness possible when this chain is used. The machine shown is a Whitney hand-feed milling machine at the works of the Western Electric Company, of New York city, which machine was originally belt driven. The speed cone has been removed and a rocking table substituted for it, supported by the existing bearings. On this the motor is mounted, and the distance between the center of the motor shaft, and the center of the driven shaft is kept constant by rocking the motor by means of the distance bar shown at the side of the chain. This is necessary because of the otherwise great variation between the centers, due to the raising and lowering of the head of the machine.



CHAIN DRIVE FOR HAND MILLING MACHINE.

This is an example of the adaptability of this chain to any prevailing conditions.

Storing Patterns by their Sizes and Shapes.

BY G. E. FLANAGAN.

Anyone familiar with the problem of pattern storage will readily admit that it is a question of considerable importance, and one for which it is impossible to devise an answer that will meet the requirements of all cases. Possibly the condition which presents the most numerous difficulties is that in which several thousand patterns are to be cared for, ranging in size from a silver dollar to a wood-shed, and of shapes more various, if possible, than their sizes, and from many of which castings are required to be made in iron, steel, brass or malleable iron, as the case may be.

An extended experience with a large number of various patterns has led me to the conclusion that they are best stored upon some system which will arrange them with reference to their size and shape. In the beginning, an effort was made to arrange the patterns with reference to the material from which the casting was to be made, a method that has some advantages, but possibly a greater number of drawbacks. The usefulness of a pattern is not strictly confined to making castings in one material. Those designed for cast iron are very often used for steel or malleable iron, and occasionally for brass. At another time, the arrangement was made with regard to the class of machinery for which the patterns were used, the idea being to keep all patterns for a given tool together. This plan is very satisfactory where a full set of patterns is made for each machine, and when the largest of them is of only moderate size, but it results in trouble when one pattern is used for many purposes, or when they are of such varying proportions that the smaller and more fragile ones become broken while handling the larger ones. If they are stored according to their size and shape, this difficulty is removed; and if they are plainly marked and properly catalogued, there need be no difficulty in finding what is wanted. When a given pattern is required, its size and appearance are at once known and this of itself directs the search to the place in which it is most likely to be found. When very much pressed for room, this system is undoubtedly the best that can be devised for storing a large number of patterns in a given space. Long cylindrical patterns, short chunky ones, large circular disks, slender board-like shapes, or light open frameworks can each be stored to greater advantage when placed with others of its class than when arranged with a total disregard of either size or shape. Gear wheels are best kept together, arranged with relation to their diameters and without regard to whether they are to be cast in steel or iron; and, of course, the same rule applies to pulleys or similar shapes. Long narrow patterns may be stood upon end in a high building or laid horizontally in a low one, but in either case may be stored very compactly if size and shape are the only considerations which govern their arrangement. Ring patterns, such as flanges, glands, followers, collars, etc., are often slipped upon projecting bars and are quite easy of access, except that the outer ones must be removed before the inner ones can be taken off. Patterns for bushings are arranged on racks with their ends showing like rolls of wallpaper. In short, there are many ways of saving space when

storing with reference to size and shape that are not available with any other method.

To mention core boxes brings up another very vexed question. It would be highly desirable to have the core boxes kept along with the patterns they are used with, but this cannot always be done. Aside from the fact that the same core box is often made to serve more than one pattern, they are sometimes more bulky than the patterns themselves, and are of construction that renders them more easily broken or destroyed, consisting as they often do of a skeleton framework of guide bars and movable sweeps. Many of these are best stored by hanging them to walls or posts, or even to the roof, as chairs are in some furniture warehouses. Large patterns with which small cores are used often have the boxes for the same nailed to them, as they lie in the storehouse, and this is a very good method within certain limits of size. In general, the method of disposing of large boxes is to store them in the space most available, with the patern number painted on them in large figures and their location noted in the pattern catalog.

While it is no doubt the case that loss most commonly occurs through lack of system, it is quite possible to go to the other extreme and establish a system so elaborate that it costs more than it is worth. The pursuit of an idea is not to be recommended in pattern storage, any more than in any other department, beyond the point which promises an increase in the profits. It is just as cheap to make a few extra patterns as to spend the same amount of money trying to avoid the necessity for doing so, with the additional advantage that the patterns may chance to be useful at some future time. The system should be adjusted as closely as possible to the needs of the case, with a due regard to the possibilities of future growth.

A German Piston-Ring Grinding Machine.

The accompanying half-tone and line engravings illustrate a piston-ring grinding machine with electro-magnetic chuck made by J. E. Reinecker, of Chemnitz-Goblenz, Germany.

The total hight is 1,850 mm. = 72.8 inches; the floor space is 1,120x1,290 mm. = 44.1x47.6 inches. The table and the magnetic chuck are 1,000 mm. = 39.4 inches in diameter, and the machine takes in and grinds up to this diameter.

The essential features of the machine are the table drive and that of the grinding slide or carriage, the automatic guidance of the latter, the automatic tightening of the emery-wheel belt and the protection of the guides from emery dust.

The table, which has three speeds, is driven from the countershaft by a three-stepped pulley. Its pivot has white-metal bearings; its circular ways, which have a mean diameter of 525 mm. = 20.7 inches, are continually covered with lubricant; are surrounded by a cylinder cast in one with the table, and are by this and a special ring *a* protected from dust. The grinding carriage is driven by the stepped pulley *c* on the shaft *b*, and *d* on the shaft *e*. This drives, by means of the bevel gears *f*, the vertical splined shaft *g*, which actuates the double clutch sleeve *h*, for the automatic right and left motions of the carriage. For this purpose the lever *i* meshes in the groove of the double clutch sleeve *h* and drives it upwards or downwards; being itself thrown by the carriage striking the vertical lever *k*, borne by the same shaft as *i*, and a special tension spring *l*. This causes meshing of either the upper or the under cone wheel, which have clutches and the bearings of which lie in an arm cast in one piece with the cross-bed. This action drives the worm *m* and by means of this drives to right or to left the worm wheel *o*, carried by a friction muff *n*, and in the axis of which lies the grinding carriage spindle. The hand wheel *p*, which is keyed to the grinding spindle by a spring key, has a friction cone and can therefore be put in gear with the friction bush *n* by the nut *q*, thus setting in motion the grinding spindle, and through this the grinding carriage. The lever *r*, actuating the clutch, enables hand control of the machine.

The grinding spindle has three bearings, and fine vertical adjustment by means of the screw *s*, through which latter the grinding head, which is in fork or yoke form, gets also its greatest vertical adjustment. The automatic tightening of the emery-wheel belt is effected by two spiral springs *t t*, each of which is pressed against the belt-drum bearings by a set-screw spindle *u*, these last bearing in nuts each having its own stand. Considerable differences of belt length are taken up by hand by means of the set-screws *u u*.

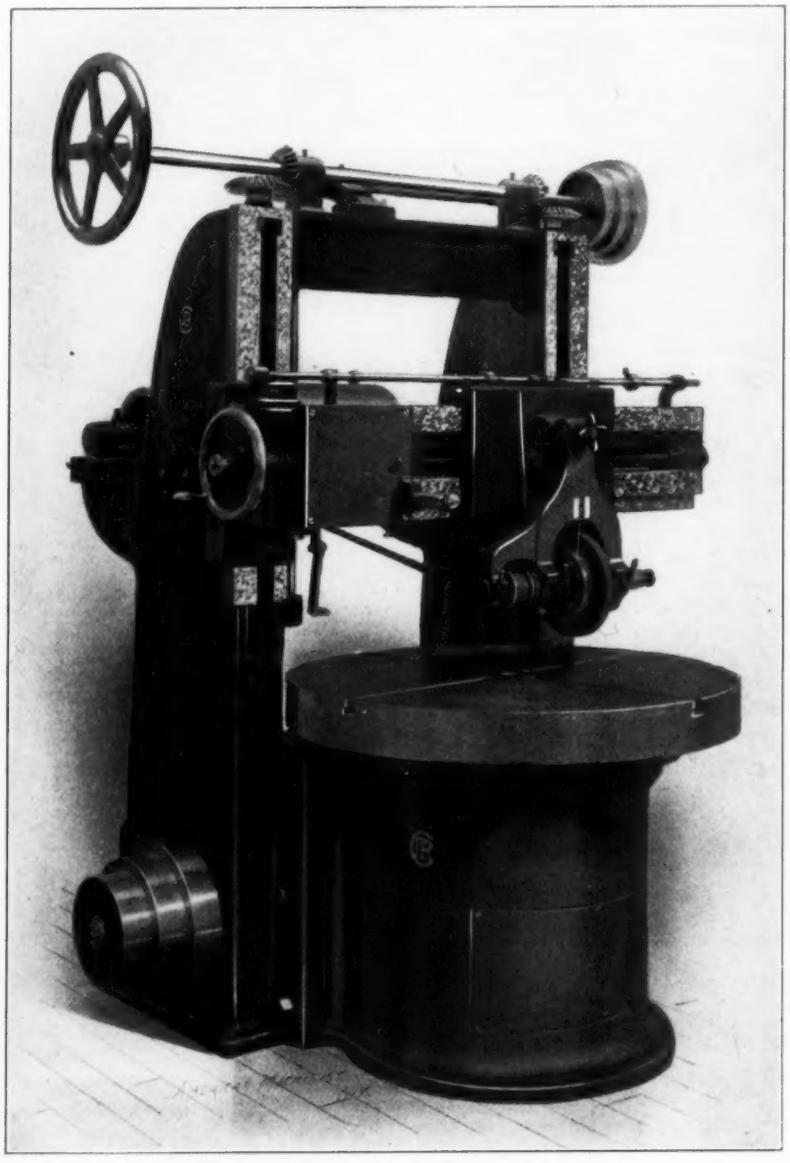


FIG. 1. GERMAN PISTON-RING GRINDING MACHINE.

The spring meeting of the A. S. M. E. will probably be held at Saratoga, and is likely to take place in the latter part of June.

Foreign Markets for American Machinery.

One of our manufacturers has recently returned from a visit to Düsseldorf. He was particularly struck by one of the works visited in Luxembourg. The amount of new machinery he saw there, which had been put in within a very short period, struck him as something quite abnormal. The principle adopted in that vast establishment seemed to him as being the American method emphasized. There were new tools, new plant, new arrangements for power, which in a very short time had cost the proprietors many millions of marks (a mark equals a quarter dollar). The principle adopted was that anything new that was good must be obtained, although expensive machinery and other appliances had to go to the scrap heap. This manufacturer was struck, too, by the way the men worked. The leading manager told him that there was practically no interval of rest, not even on Sundays, and that the only holiday he (the manager)

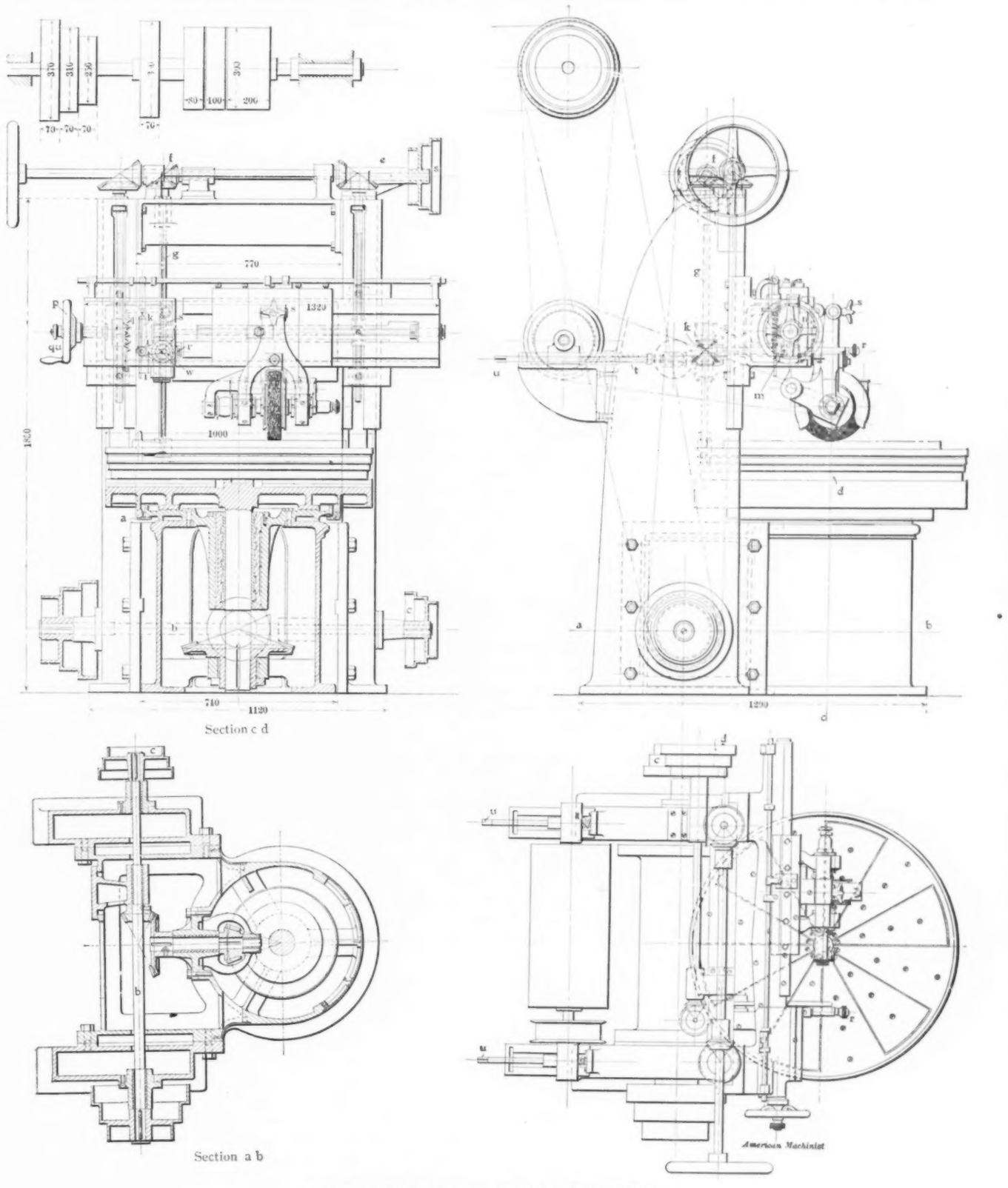


FIG. 2. GERMAN PISTON-RING GRINDING MACHINE.

had was when he could snatch a short time from 7 to 9 o'clock.

Another point that struck the visitor very much on the Continent was the railroad management. In England, with the many competing railroads, it would be supposed that manufacturers reaped the advantage of rival enterprise. That is not the case. The very severity of the competition compels the railroad managers to come to making arrangements. The effect is to keep up the rates to such an extent that the long-distance quotations given by English railroad companies to foreign manufacturers handicap the British producers. For example, 500 tons of material had to be sent to Glasgow and the route touched the lines of three railroads. The ordinary rate is 13s. 4d. (say, $3.30) per ton, and a special rate of $3 is frequently granted. The companies refused the special rate, and consequently the goods were forwarded by a long route and the companies themselves made considerably less profit than they would otherwise have done. Small places on the Continent, not a quarter the size of Sheffield, in England, have good railroad depots with splendid freight accommodation, and the State management there gives no loophole for the loose way in which English traffic is worked. Freight on the Continent is invariably sent by the shortest route, and thus not merely are low rates obtainable, but dispatch in business is obtained as well.

. . . . . .

There are some curious fluctuations in industries. For instance, some time ago two at least of the great Sheffield steel makers put up huge factories in the United States to manufacture "inside the tariff wall" and to compete with American makers for trade within the States. But now British home manufacturers have nothing to fear in the English market from United States importers; indeed, large purchases are being made here for America. A year ago the Germans were keen competitors—so keen that they drove Sheffield makers of middle grade steels out of the market. But it seems that the Germans, with a view to capturing outside markets, had accumulated very large stocks. Financial difficulties came to many of the German steel men, as they did to most of the manufacturers in the Fatherland last year and this year. Pressed for money, they had eventually to realize on their stocks, huge consignments of steel coming to England last year simply to raise money. Prices were absurdly low and ordinary competition was out of the question. These stocks have now been largely cleared and competition from Germany in middle grades has declined. The Teutons have found that there is such a thing as trade without profit, and their extensive system of credit in their export trade in doubtful markets is a source of weakness to them. The business got by Germans abroad is often such that there is precious little, if any, hard cash in it. British exporters have been that way years ago and have given it up.

. . . . . .

I hear that there is considerable inquiry at Shanghai for Cornish pumps, ventilating machinery, rock drills, and machinery used in coal and other mining. Several of the provincial mining centers held by Americans, Belgian and French syndicates are all busy surveying and building railroads north and west of Shanghai. In sending catalogs to this place, always give prices, as orders are frequently placed elsewhere when such information is omitted. There is a demand for minting machinery, as the new treaty of commerce calls for a uniform coinage.

. . . . . .

It would be worth while for American railroad contractors to watch the Formosa market, as during the coming year tenders will be wanted for twenty miles of rails and nineteen spans of plate girders. The United States and Britain divide the Formosa market for rails, spikes, bolts, etc. Most of the locomotives are shipped from England, while America and Britain supply the bridge work, girders, etc., but those of plate girder type are imported in plate, and are built up by the local branch works of the Osaka Kisha Kaisha.

Makers of cheap water-raising apparatus will find a good market in Egypt for such goods. At present it takes six men to hoist the contents of six buckets of Nile water to the top of the bank. Petroleum has been found near Suez, so gasoline engines ought to sell well throughout the country.

F. C. C.

London, England.

Diagrams for Semi-Elliptic Plate Springs—Errata

Some errata occur in the formulas of Mr. Fry's article published at page 1680. The readings should be as follows:

Page 1682:

Col. 2, line 3, $W = \frac{n f b h^2}{3 l}$ (1)

line 18, $W = 25{,}000 \frac{n b h^2}{l}$ (2)

line 20, $\frac{W}{n} = 25{,}000 \frac{b h^2}{l}$

Col. 3, line 3, $n = \frac{W l}{25{,}000 b h^2}$ (3)

line 5, $W = 25{,}000$ pounds.

The above corrections do not affect the diagrams or the reasoning in any way.

Herr A. Bernhard, of Hamburg, Germany, has discovered that aluminum is valuable for sharpening cutlery. "Though a metal, aluminum has the structure of a fine stone, possesses a fine dissolving power, and develops during the whetting process an exceedingly fine metal-setting substance, greasy to the touch, while showing strong adhesion for steel. The knives in a short time obtain such a fine razor-like edge that even the best whetstone cannot compete with the result."

Letters From Practical Men.

A New Principle in Hydraulic Presses.

Editor American Machinist:

Having read the descriptions of different styles of hydraulic presses under the above heading at page 1641, it seems to me doubtful if there is anything about them so different from previously used presses as to deserve being called a new principle. The word principle, however, is one not accurately defined, so that question may be waived, but it will be pertinent to compare them with previous practice.

The hand-operated press, Fig. 1, is a substitute for the common jack press, and differs from it in operation chiefly by having the small plunger moved by a screw instead of a lever. It is well known that such a screw has a very low efficiency as a force transmitter, seldom exceeding 60 per cent. It has been demonstrated by ample experience that the hand-lever-operated plunger pump has a higher efficiency than that. The screw-operated plunger has other disadvantages. The return of the plunger is slower and more laborious than on the jack press; it not only has to lift the plunger but the reservoir and all the liquid as well. True, this weight is all recovered again on the down stroke, but the speed lost and the friction of the screw in raising this whole weight, is time and force wasted..

As to the geared and belt-driven press, I do not see how it can possibly equal in efficiency the belt-driven crank and plunger press which it seeks to supersede. It has the friction of the gearing added to that of the screw, to lower its efficiency. There is no novelty in the use of a screw for working a plunger, as it has been used a number of years to produce pressure in gage testers.

The design has some advantage in compactness, but it is secured at the expense of accessibility. Observe the difficulty of renewing the packing on the small plunger in each of the designs.

The design in Fig. 7 is a modified form of using what has been known for several years as an "intensifier." Here again compactness has been secured at the expense of convenience. The packing around the small plunger and around the pipe within it can be renewed only by entirely removing both plungers, the cylinder head and the piston head. Everyone who is experienced in the use of hydraulic machinery knows how important it is to have it designed so that all the leather packings can be replaced with the least loss of time, for they nearly always give out when you are in the greatest hurry.

Where an intensifier is used it is better to have its cylinder and plunger independent of the press and connected to the press cylinder by piping only. The only reason I can see for placing it as shown in Fig. 7 would be that there was no

room elsewhere around the press for it. I can see one advantage of the screw-operated plunger; it gives a steady pressure free of pulsations.

The designer of these presses has shown undoubted inventive ability in getting them up, and there is no doubt that there may be special conditions in which they might be preferable to the older forms; but before anyone adopts them they should consider carefully the objections I have pointed out.

Under the usual or average conditions where there is room to properly install them, there need be no fear that the older forms of direct-operated presses will suffer any in comparison with this new rival. BELL CRANK.

[Regarding the efficiency of screws, it is proper to remark that satisfactory efficiency can be secured with them by making them of steep pitch angle. The principle is precisely the same as with worm gearing, in which the influence of the pitch angle on the efficiency of the gear is now well understood. Moreover, even with a low angle screw the loss due to its low efficiency is experienced during a small portion of the working stroke only, and, under most conditions, this loss would, we think, be much less than that due to the use of high-pressure water for the idle motion of the ram.—Ed.]

Hoisting Drums.

Editor American Machinist:

Exception must be taken to Mr. Flanagan's method of casting drums upon shafts described at page 1508. This practice represents only the very cheapest and roughest work, such as contractors' derricks, etc. No crane that ever came under the writer's notice ever had a drum cast on the shaft. Mr. Flanagan further says that drums are weakened by the cutting of grooves. This also is a mistake, as drums are, or should be, designed to have sufficient metal at the bottom of the grooves to withstand the strains.

At page 1180, Vol. XXIII, the writer gave some notes on the design of crane drums, giving a formula for the thickness as

$$t = \frac{T}{f_c\, d} \qquad (1)$$

where

t = the thickness of drum under ropes,
T = the tension in the rope,
f_c = the allowable compressive fiber strain in pounds per square inch,
d = the diameter of the rope.

This formula considers the drum as a cylinder under uniform compression normal to the surface of the drum. Mr. Flanagan wishes to consider the drum as a beam supported at the ends and loaded at the middle. With long drums it is important to do this, and select the greater thickness, as calculated by the two methods. The writer lays no claim to originality in what follows, but presents it for discussion with the permission of others:

Let Fig. 1 represent the end view of a drum wound full of rope under tension T. To represent the condition of equilibrium we may suppose the drum held between two slings of rope g and h, each sling being under tension T. There will be compression at the planes $a\,b$, and at all other radial planes. In Fig. 2 are represented two unit cubes in the shell of a drum. These unit cubes are each under compression, as shown by the arrows c. In each unit cube there is also a stress induced by the bending moment upon the drum considered as a beam. This stress will be tension in the bottom of the drum, and compression in the top, as shown by the arrows i and e, respectively. In the bottom unit cube, the compression in direction of arrows c tends to elongate the cube in the direction of arrows i. According to Poisson's ratio, the force tending to elongate the cube will be 0.27 of the force of compression in direction of arrows c.

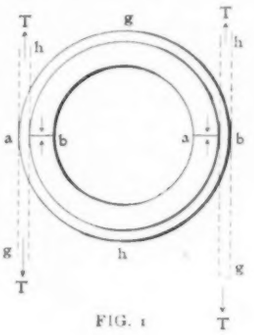


FIG. 1

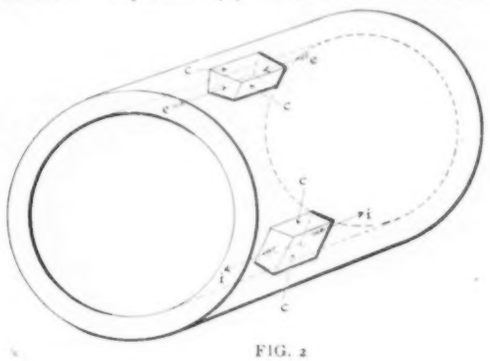


FIG. 2

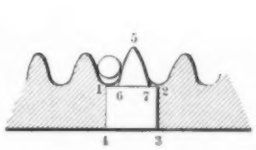


FIG. 3

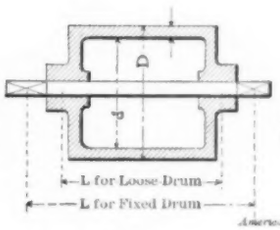


FIG. 4

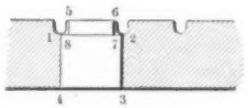


FIG. 5

THE DESIGN OF HOISTING DRUMS.

The section factor of the drum is

$$Z = \frac{\pi}{32}\left(\frac{D^4 - d^4}{D}\right)$$

and

$$M = f_T\, Z = 0.098\, f_T \left(\frac{D^4 - d^4}{D}\right)$$

$$f_T = \frac{10\,M}{\frac{D^4 - d^4}{D}} = \frac{10\,M\,D}{D^4 - d^4} = \frac{2.5\,T\,L\,D}{D^4 - d^4}$$

approximately.

This is the fiber stress per unit area in the bottom unit cube, in the direction of arrows i, which is induced by the bending moment. To this fiber stress must be added that due to the compression in direction c, which will be found to be

$$\frac{0.27\,T}{A},$$

and we have:

$$f_T = \frac{2.5\,T\,L\,D}{D^4 - d^4} + \frac{0.27\,T}{A} \qquad (2)$$

Equation (1) considers the drum as failing by collapse, and equation (2) considers the drum as a beam failing by flexure.

Whichever gives the greater thickness is to be followed in any particular case, as (1) is applicable to short drums of large diameter, while (2) is applicable to long drums.

Equation (2) may be called a cut-and-try method, since the dimensions of the drum are to be assumed and the resulting fiber stress calculated. The expression for the thickness derived from this equation becomes greatly involved, and the solution more troublesome than the form given. The value of f_T so calculated should not exceed 3,000 pounds per square inch for cast iron.

The method for a chain drum is the same as the foregoing, except that the grooves are as shown in Fig. 5, and the area A = the area of 1, 2, 3, 4, plus the area of 5, 6, 7, 8. C. F. BLAKE.

Molding a Pipe Flange on a Molding Machine.

Editor American Machinist:

The sketch shows the construction of a pipe flange pattern and stripping plate for a molding machine. To the pattern-maker this may be somewhat a puzzle until he is familiar with molding machine work.

Fig. 1 is a section of the flange pattern

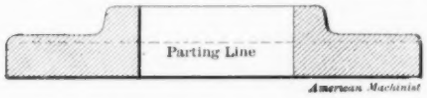


FIG. 1. SECTION OF FLANGE.

to be molded. Fig. 2 is the part of the pattern in the cope. To make this more clear I have shown this by dotted lines in the drag, Fig. 3. Understand, the dotted line has nothing to do with the sketch or pattern; it is simply to make more clear. The cope part of the pattern is built on a standard size follow-board which fits a molding machine. Fig. 3 is the drag; *B*, pattern; *C*, stripping plate, which is fitted also to the machine; *D* is a thickness piece which is fast to *C* and rests on plate *E*; *E* is a plate to which pattern *B* is fast. This is also bolted to a vertically moving part of the machine, which, by a movement of a lever, draws pattern *B* out of the mold. While this is

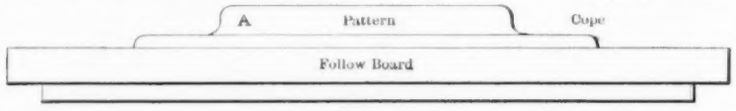


FIG. 2

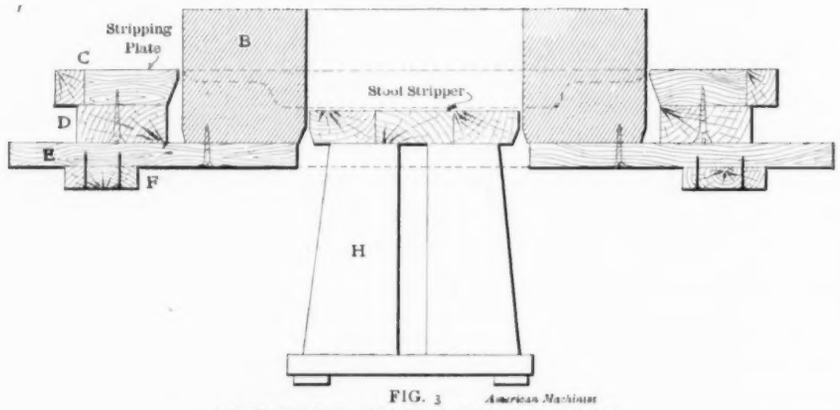


FIG. 3

A PIPE FLANGE ON THE MOLDING MACHINE.

being done, the center hole is stripped by the stool stripper, which is a fixture. *F* is a batton on *E*, *H* a distance piece between the stripper and base.

MILWAUKEE.

The Right of Appeal in the United States Patent Office.

Editor American Machinist:

In your article on the "Modification of the English Patent Law," at page 1724, you say: "The objection which the Englishman has to our method is that by the act of the examiner an inventor may be denied a patent to which he is justly entitled. Of course in our case the applicant may appeal to the examiner-in-chief of the division and ultimately to the Commissioner of Patents, but the English idea is that the appeal should be to the courts which their present system insures."

This is misleading in two particulars: First, the examiners-in-chief are a board of three, constituting an intermediate tribunal between the examiner of each and every examining division of the Office and the Commissioner of Patents; second, the right of appeal is not exhausted by appeal to the Commissioner in person, but may be taken "to the courts" to an extent probably as great as that contemplated by the English bill.

The annexed sections of the Revised Statutes and amendatory acts govern the course of appeal of an applicant whose opinion of the patentability of his invention differs from that of the primary examiner or other tribunals of the Patent Office:

"Sec. 4909. Every applicant for a patent or for the reissue of a patent, any of the claims of which have been twice rejected, and every party to an interference, may appeal from the decision of the primary examiner, or of the examiner in charge of interferences in such case, to the board of examiners-in-chief; having once paid the fee for such appeal

"Sec. 4910. If such party is dissatisfied with the decision of the examiners-in-chief he may, on payment of the fee prescribed, appeal to the Commissioner in person.

"Sec. 4911. If such party, except a party to an inteference, is dissatisfied with the decision of the Commissioner, *he may appeal to the Supreme Court of the District of Columbia, sitting in banc.*"

(Note: Secs. 4912 and 4913 are probably not necessary to give a connected idea of the statutory provisions of appeals.—W. D. G.)

"Sec. 4915. Whenever a patent on application is refused, either by the Commissioner of Patents or by the Supreme Court of the District of Columbia upon appeal from the Commissioner, the applicant *may have remedy by bill in equity;* and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge that such applicant is entitled, according to law, to receive a patent for his invention, as specified in his claim, or for any part thereof, as the facts in the case may appear. And such adjudication, if it be in favor of the right of the applicant, shall authorize the Commissioner to issue such patent on the applicant filing in the Patent Office a copy of the adjudication, and otherwise complying with the requirements of law. . . ."

The act of February 9, 1893, creating the Court of Appeals of the District of Columbia modified the above by substituting that court for the Supreme Court of the District as the appellant tribunal in patent cases, including interference cases as well as those of a single applicant. Its provisions regarding such appeals are:

"Sec. 9. That the determination of appeals from the decision of the Commissioner of Patents, now vested in the general term of the Supreme Court of the District of Columbia, in pursuance of the provisions of Section 780 of the Revised Statutes of the United States, relating to the District of Columbia, shall hereafter be and the same is hereby vested in the Court of Appeals created by this act; and, in addition, any party aggrieved by a decision of the Commissioner of Patents *in any interference case* may appeal therefrom to said Court of Appeals."

It will thus be seen that the rights of all inventors are amply safeguarded, and they are far from being precluded in securing a patent for any meritorious invention by any peremptory or arbitrary act of any officer or tribunal of the Patent Office. I do not see wherein the proposed English law can be more just, liberal or even advantageous. No matter how insignificant the invention, this entire course of appeal is open to any applicant, if he thinks "the game worth the candle."

W. D. GROESBECK.

Washington, D. C.

[This right of appeal is, we believe, very seldom exercised in practice.—Ed.]

Sizing Blanks for Drawing.

Editor American Machinist:

In my note at page 1553 on "Sizing Blanks for Drawing" I gave the size of the original shell for a bicycle pump as 3⅜ inches in diameter and 2 to 2⅞ inches high, and the blank 5⅜ inches." Instead of this it should have read: 3⅝ inches diameter, 3 inches high and the blank 6⅞ inches.

EXPERIENCE.

Indexing Periodical Literature.

Editor American Machinist:

At page 1454 is a note by "Constant Reader" as to the need of an index. I think that, beside your correspondent,

many others have felt this need and are also equally convinced of the practical impossibility of arranging a card index that would be anywhere nearly complete enough.

I do think, however, that there is a solution possible and one that is novel only in this particular application.

I would suggest that the Dewey index be used as a basis and that the particular index number be printed behind each and every article in the paper. Those who care for handy preservation could then cut the paper apart and file the various articles in order of their numbers.

I, for one, am doing that for the present, not only with the AMERICAN MACHINIST, but with other technical periodicals as well.

No doubt this will result in the loss of an imposing array of fine bound volumes from the first up to date, but it will undoubtedly also result in what after all is a main thing, making the contents readily available at all times.

Possibly the business office may consider the fact that a fair proportion of the readers will want a double issue in order not to lose any articles an equivalent, and I am sure that not a few readers who rate the paper as high as I do would be pleased to subscribe for an extra issue or to pay an extra price for an issue printed on one side only. HENRY HESS.

Berlin, Germany.

Large Screw Threading Dies.

Editor American Machinist:

The toolmaker knows what difficulties attend the making of a large die from solid stock, and the cost keeper best knows how very expensive it is. I show here a form of die which, for sizes from 4 or 5 inches up, may be used to good advantage. Besides that, the first cost of the die is less than if it was made out of the solid. Broken or cracked cutters may be replaced and after they become worn an entirely new set can be made to replace the old ones at a very small cost as compared with the making of a new die.

Fig. 1 shows the die complete. The body *A* is made of malleable iron or a steel casting—the latter preferred. The prongs are cast as shown, and do not need to be milled. The casting for the body is best finished all over on the outside, the inside being turned true the length of the cutters. The shank may be turned to fit an ordinary die-holder, as shown, or it may be screwed solid to a stem fitted to the turret hole, the manner of holding depending somewhat on the class of work.

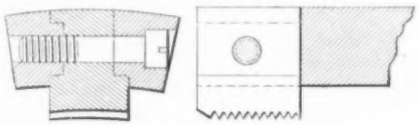


FIG. 2

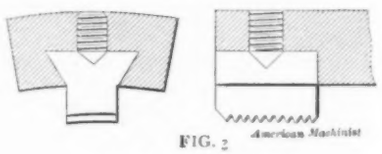
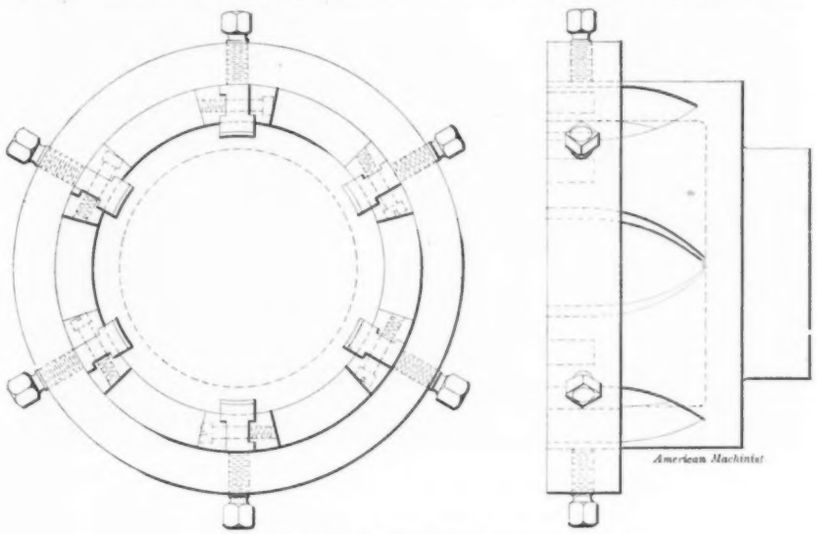


FIG. 3

DETAILS OF LARGE DIE.

The form of cutters and the manner of holding are shown in the enlarged section Fig. 2. The casting, after being turned, is held in the chuck attached to the milling machine head, and the slot is milled by a small end mill made for the purpose. Held in this manner the slots can be accurately spaced by the index plate. The cutters are cut from a solid bar milled to the correct section; this insures uniformity in their size and shape. Some adjustment of the cutting edge of the die is possible by tightening or loosening the screws in the encircling ring and thus springing in or out the horns which carry the individual cutters. Fig. 3 shows another form of tooth, which may perhaps be a more simple form to make, but which requires a special attachment for milling. S. R.



A LARGE SCREW-THREADING DIE.

An Echo from the Old Country.

EXPERIENCE WITH A RICH PARTNER.

There are some things one gets to learn in life that are outside of all reasonable expectation. I had such a lesson on one occasion that I have tried to act upon, not always with success. I was in possession of a knowledge of a certain business which I knew to be an excellently paying business. I was as thoroughly conversant with the scientific, practical and commercial details as any man in the business, and I was very confident of success and anxious to have a business of my own, for I was getting tired of seeing good business let slip to an amount that would have given me a fair start.

Finally I secured the aid of a rich man who had a son whom he wished to put into business. Never again will I join a man who has been brought up in idleness and luxury. One minute he will be weeping for the imminence of his financial ruin because something has gone wrong, as things will go wrong in all business. It was useless for one to point out that did such mishaps not occur our prices would be speedily cut down by the competition of our rivals, or, if not cut down, we should rapidly become too wealthy. On other occasions small worries would lead him to the throwing-up point. He would shut down the business and get out at any sacrifice, the Old Man of course to stand the loss, in which I, however, was to share. To carry on business with such a partner, to purchase all supplies, design the plant, carry on the scientific part of the work and superintend the practical details make up a load quite heavy enough without the foolish worry over expected losses. Fire insurance companies care nothing for their morning record of fires to be paid for; nor need we have worried over any mishap that occurred, for they were merely such as, being anticipated, had been suitably allowed for.

Finally, to my satisfaction, an audit was arranged for to suit a would-be purchaser of half the business. The audit was so satisfactory that the would-be purchaser made a fair offer, which was refused. The profits were too good to be relinquished, and I saw fortune in front of me, and thought that nothing would now prevent steady progress. My deed of partnership was very stiff. In accepting it I accepted certain clauses which I felt sure would not—could not—be enforced except there was a loss. But they were threatened to be enforced unless I consented to become manager only and dropped the partnership, and the threat was made at a time of private difficulty and anxiety so as to compel my subjection. I was man enough to refuse, and it was then decided to close the business and saddle me with half the wilfully incurred loss.

One of the characters of Charles Dickens is represented as saying that the law is a "hass." The law may be an ass, and it is

a very hard thing in Great Britain for a poor man to get justice. If he has a rich opponent there will be all kinds of delays that will postpone the trial for months; but if at last your case comes into court you do get justice, to the best of the ability of judge and jury to give it you. They may make mistakes and ruin you, but they do it honestly. The Court of Chancery has particular terrors. Both sides are pretty well ruined by fighting in Chancery. As my partner had set himself on a course which would have left me penniless I was in the position of a man with his back to the wall, fighting for life. Do our bidding and be ruined, was their weapon. My reply was, as I have got to be ruined anyhow, I will have a run for my money and will be ruined with banners flying and drums beating, and I will just put this business into the Court of Chancery to settle. This was a sufficient threat to make them let me go. I simply walked out, and they sold off the plant to a stranger for just one-third of my offer, rather than continue to share an annual profit which had been at the rate of 50 per cent., "for," said they, "you are going to make too much money."

I learned from this to avoid the sons of rich men who have not had a training of work from youth. I learned also that it is undesirable to have the help of a very rich man in a small business which he can pitch into the sea, if he gets tired of it, and not feel the loss. I want a man to help me who does not think he can afford to lose money or to cut off a business that is paying, simply because he is tired of it. I found my ideas had been wrong. My one anxiety had been to show a success, for I had the fear of the clauses of the deed before me, and I had no shadow of an idea that when I had proved my capacity to make a profitable business any man would quarrel with his own deed which gave 5 per cent. interest to his capital and shared the remainder. I ought to have learned the lesson that greed will so blind a man to his own interest that he will overreach himself to grasp more than his due. I did not learn that lesson, however, but later experience has convinced me that there are men who are so consumed with greed that they will do anything rather than give a man his rightful due.

The old Levitical Law tells us that "thou shalt not muzzle the ox that treadeth out the corn," yet men do this daily to their own injury. I believe that the worst possible thing that can happen to a business undertaking is to have at its head men who keep their employees in a state of unrest and uncertainty. Some men think they are hustling when they instill the fear of the "sack" into all their staff. Living on a sleeping volcano begets either indifference or a strenuous endeavor to find a fresh home. Men can rarely work when unsettled by a constant fear that they may any day have to combat an unfair cut, a squeeze, a refusal to keep a bargain or any one of the stratagems of the over-cute.

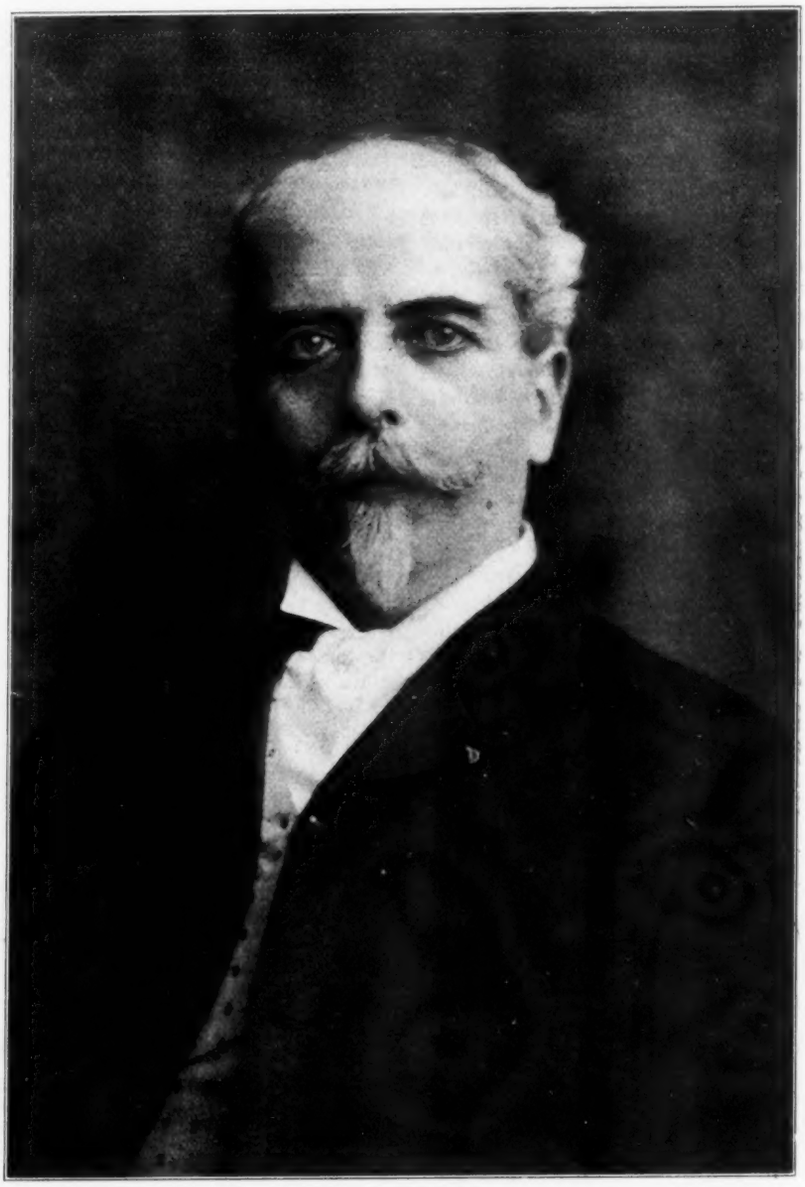
My detailed experience, now some years gone by, may be of service to those who may be tempted to receive aid from the well-to-do. It may warn them that a man may be too rich, that he may be rich and withal too greedy, too greedy to bear that the man who has found the brains of the business shall become rich also, too rich to care to make money unless he can have it all. Avoid the man of no brains; he grudges the payment for the brains of others. Don't think that men will necessarily follow the path of their interests, for greed will turn them aside. When dealing with poor men don't think, on the other hand, that you can compel them to your ways by threats of poverty, ruin or starvation. Even poor men have sentiments, and I know one such to whom the recollection of Ladysmith has been a very present help in time of trouble. Men will go through a good deal to keep a bit of tattered rag flying on a pole. Looks foolish, doesn't it? but, as Shakespeare wrote:

"The endeavour of the present moment
May buy that honor
Which shall make us heirs of all eternity."

Great Britain. A. TYKE.

James M. Dodge, the New President of the American Society of Mechanical Engineers.

The career of Mr. Dodge, although the story of it is not a long one, would seem to fully justify his selection for the position to which he has been called. He is now fifty years old. He was born at Waverly, N. J., on the farm of his grandfather, the late Professor James J. Mapes, the noted chemist and natural scientist. His mother is Mrs. Mary Mapes Dodge, whose unique record as the editor of *St. Nicholas* is familiar to all. After the usual school experience, Mr. Dodge spent



JAMES M. DODGE, PRESIDENT AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

three years at Cornell University and one year at Rutgers College, New Jersey, where he took a special course in chemistry under Prof. George H. Cook, geologist. He then served an apprenticeship at the Morgan Iron Works, New York, and was for several years employed in John Roach's shipyard at Chester, Pa. After that he went to Chicago and entered the employ of the Ewart Manufacturing Company in the manufacture of link-belting, which line of business he has followed ever since. Mr. Dodge is now president of the Link-Belt Engineering Company, of the Dodge Coal Storage Company and the Stair Lift Company, besides being a director in several other concerns. Mr. Dodge's special mechanical qualifications are evidenced by the fact that he has taken out considerably more than one hundred patents, a number of which have proved commercially valuable. Mr. Dodge became a member of the Society May 21, 1884. He served as manager from 1891 to 1894, and has been vice-president for the past two years. The office would seem to have come to him in the regular line of promotion, and, being both a fully qualified and experienced engineer and an active and successful man of affairs, he would seem to be pre-eminently the man for the place, and the Society should be led into strict business ways and prosper under his guidance.

Annual Meeting of the American Society of Mechanical Engineers.

The forty-sixth meeting of the American Society of Mechanical Engineers opened according to program at the house of the Society Tuesday, December 2, at 8.30 P. M. Owing to the illness of President Edwin H. Reynolds and his inability to attend, the usual presidential address was omitted, and instead of that the presentation and consideration of Prof. Sidney A. Reeve's paper took place. This paper was entitled

A RATIONAL SOLUTION OF THE PROBLEM OF WEIGHTS AND MEASURES.*

BY SIDNEY A. REEVE.

This paper is a revival of the scheme for reconstructing our system of arithmetical notation on the duodecimal basis, the number 12 being written as we now write 10 and the number 144 as we now write 100. Students of fundamental arithmetical problems are well aware that the number 12 is a much better basis of notation than 10, and Professor Reeve explains the advantages of 12 in a lucid manner. He gives two additional characters which are needed, and likewise supplies a new scheme of names. He considers the difficulty of thinking in the proposed system to be much less than is commonly imagined, for the reason that we already think to a greater or less extent in dozens, and this is all that is required in connection with the duodecimal system. In fact, he considers that the real difficulty is not in thinking in the new notation but in forgetting to think in the old notation. One of the advantages of the duodecimal system which he names, and which we do not remember having seen referred to before, is that the learning of the multiplication table is much simplified. It should be noted, also, that the author is not a believer in the superiority of the metric system.

The author had on exhibition several charts showing the simplicity of calculations by the duodecimal system and of the linear measurements based upon it. He showed how easily the workman could use it, and explained that he need not learn to think in the system except gradually and easily, and that, so far as machine shops are concerned, the multiplication table need be learned by those in the drawing office only.

The paper was not adequately discussed. Several members had sent in notice of their intention to discuss it, but they were not present, due apparently to the fact that the paper was presented the first evening of the meeting, before these members had arrived. Such discussion as took place consisted chiefly of questions and answers between members and the author. The author wished especially to know whether the Society was disposed to take the idea seriously in order to form an idea if it was worth while for him to follow it further, but he received little of the information which he desired.

WEDNESDAY MORNING'S SESSION.

The business session of the meeting opened in the large assembly rooms of the Sturtevant House with Vice-President Arthur M. Waitt, superintendent of motive power and rolling stock, N. Y. C. & H. R. R. R., in the chair. The secretary read some extracts from the Council's report, which report has been sent out to the members, and announced the appointment of the following members to represent the Society in the John Fritz Medal award: Prof. Gaetano Lanza, of Boston; Prof. John E. Sweet, of Syracuse; R. W. Hunt, of Chicago, and Samuel T. Wellman, of Cleveland.

As a Committee on Standard Screw Threads the following were appointed: Wilfred Lewis, of Philadelphia; Geo. R. Stetson, of New Bedford; Geo. M. Bond, of Hartford; Chas. C. Tyler, of Pittsburgh, and John Riddell, of Schenectady.

The report of the Tellers of Election was read, showing that fifty Members, ten Associates and thirty Juniors had been elected.

The Committee on Rules and Methods then made a report through its chairman, C. W. Hunt. He stated that in answer to requests, twenty-six suggestions had been received by the committee from members, and that the following points had been and were under consideration:

Shall dues of Juniors be increased?

Shall fees of Life Members be increased or graded according to age?

How many adverse votes shall defeat a candidate for membership?

Shall Past Presidents continue to be members of the Council?

How many members shall constitute a quorum at annual meetings?

Shall local groups of the society be formed in the various cities of the country where deemed advisable?

He asked that the committee be continued, as its work was not yet completed.

The matter of the proposed increase of dues for Juniors provoked quite a lively discussion. It has been shown that the dues of Junior members are not sufficient to defray the expense of keeping them upon the rolls, and Mr. Jesse M. Smih, of the committee, offered a resolution designed to call out an expression of opinion from the meeting as to what should be done about it. Many members gave their views upon it, and the general sentiment clearly was that it was not advisable to go on as now with gray-headed men as Junior members. Some favored a gradual increase of dues up to the full amount of other members. Others favored an age limit beyond which no Junior should be retained on the rolls as a Junior, but should then apply for Full or Associate membership. Finally it was voted as the sentiment of the meeting that the committee should adopt as part of its report a by-law or rule providing for the advance of dues or for the transfer by the regular methods from the Junior grade to Associate or Full at thirty years of age.

The proposition sent out to the members, proposing to change rule 45 so as to allow voting by letter ballot, was then taken up. It developed that the committee had not been able to agree upon this matter and that Henry R. Towne, because of this disagreement, had concluded that he could be more useful by working outside the committee than as a member of it. He had therefore withdrawn from it, and Prof. D. S. Jacobus had been appointed in his place. When it came to a question of voting, the query arose as to whether a proposed amendment, notice of which had been given, had to be voted upon precisely as proposed, and the chair ruled that it need not be, but that it needed only to be germain or of the same general import. It was shown that under that ruling three different amendments were before the society for action—that offered by C. W. Baker one year ago and slightly amended at the Boston meeting; one offered by Fred J. Miller at Boston and slightly changed, endorsed and sent out by the committee, and finally one offered by Henry R. Towne, designed to combine the best points of the others and to protect the Society from being flooded by proposed amendments, each one of which would have to be printed and sent out with a blank ballot to each member. The right of every member to a vote on

*Copies of the papers may be had for a few cents each by addressing F. R. Hutton, Secretary, 12 W 31st Street, New York.

such a matter having been established. After much parliamentary sparring, admirably held in hand by the chairman, it was finally decided to vote upon the amendments in the order of their original presentation. This gave the precedence to Mr. Baker's resolution, and the committee then abandoned its own resolution and voted the proxies held by it (about 100) in favor of Mr. Baker's resolution, which was thus adopted. The resolution, as it stands, however, is only temporary, and may or may not be included in the final draft of new rules to be presented by the committee. It will govern, however, the method of procedure and of voting upon the new rules to be proposed. At this point the meeting adjourned to 2.30 P. M. for an extra session, the business not having been yet completed and the professional papers not reached.

WEDNESDAY AFTERNOON'S SESSION.

The secretary announced the result of the canvass of the election of officers for the ensuing year as follows: James M. Dodge, president; F. H. Daniells, James Christie and John R. Freeman, vice-presidents; Wm. H. Wiley, treasurer; R. C. McKinney, S. S. Webber, Newell Sanders, managers.

Mr. Dodge was escorted to the platform, gracefully introduced by the chairman and briefly thanked the Society for the honor conferred upon him, promising for his part to work conscientiously for the best interests of the Society.

A resolution was then adopted increasing the membership of the Committee on Rules and Methods to five, and we understand that one of these additional members is to be Gus. C. Henning, while the other is to be Henry R. Towne, who had been prevailed upon to serve.

The secretary read an invitation to the members to attend the meeting of the Civic Federation to be held in New York on the 8th, 9th and 10th.

Following the business session the society took up the consideration of the

FINAL REPORT OF THE COMMITTEE APPOINTED TO STANDARDIZE A SYSTEM OF TESTING STEAM ENGINES.

This is a very voluminous report, of seventy-eight pages, which cannot be satisfactorily abstracted here. It gives minute instructions for every important feature of the test, discusses the calibration of the instrument, gives drawings of some forms of apparatus which are recommended, shows how to combine the diagrams from compound engines, explains the use of the temperature-entropy diagram and gives the forms on which the test is to be reported. The code of rules for tests of gas and oil engines of 1901 is appended. Accompanying the report is a fifty-four-page printed discussion of it.

This report had been so thoroughly considered in its preliminary form at previous meetings, that it brought out but little discussion, and this consisted chiefly of expressions of commendation for the excellent character of the report.

Following this came the presentation of

THE METRIC SYSTEM.

BY F. A. HALSEY.

This paper, which occupies forty-eight pages, is too voluminous for even an abstract here. It is offered as an all-around argument against the metric system. The argument relates to the great difficulty and cost of the change rather than to the question of intrinsic merit, the argument for this difficulty being based largely on the fact, which the author claims to prove, that the system is, as yet, by no means universal in France or Germany, which countries he claims are still in the transition period. At the same time attention is given to the claims of superiority for the system, the author's conclusion being that "when it comes to the claim that this metric system reduces the labor involved in the calculations of every-day life enough to be a matter of any public moment whatever, it simply is not so."

The scope of the paper can be best understood by giving its section headings, which are as follows: 1. Errors of and Misrepresentations by the Metric Advocates. 2. The Persistence of Old Units in German Textile Industries. 3. The Persistence of Old Units in French Textile Industries. 4. The Persistence of Old Units in German Mechanical Industries. 5 The Persistence of Old Units in Spanish America. 6. Reasons for the Length of the Transition Period. 7. The Adoption of the Metric System Necessitates Abandoning Mechanical Standards. 8. Examination of the Claims of Superiority for the Metric System. 9. The Foreign Trade Argument. 10. The Value of Mechanical Standards. 11. Analysis of the Bill now Before Congress. To these is added an appendix containing two sections, the first being on The Fundamental Importance of the Machine Building Industry in Modern Life, and the second on The Incompetence of Certain Testimony.

The author did not read an abstract of his paper, but instead made certain deliveries of books and other evidences which the paper promised as indications of the persistence of old units in countries in which the metric system is officially adopted. Among other things he had a collection of German-made rules containing, in addition to millimeters, English, Rhenish and French inches, and a copy of Special Consular Reports, Vol. XVI, containing an extended table of foreign weights and measures in which, of non-metric units used in metric countries, he had counted 475 and of which Germany claims 112.

The discussion, to put it mildly, was animated. Mr. Southard, chairman of the Committee on Coinage, Weights and Measures of the House of Representatives, and Dr. Stratton, Director of the Government Bureau of Standards, were present by special invitation and were given the privilege of the floor. The discussion occupied the entire session, a special session of Wednesday afternoon and all of the evening session in addition. It was opened by a written discussion by Mr. Colvin, who had examined the last two volumes of the government publication, "Commercial Relations," and had found many examples of the mixed use of metric and native units in consular reports and in translations of native publications.

A large number of letters had been received from manufacturers and others—so many as to make it impracticable for all of them to be read. Of these the secretary stated that none from manufacturers favored the system.

The first speaker was Dr. Stratton, who insisted that the purpose of the bill was entirely misunderstood, that he deprecated any compulsory legislation and that, as a matter of fact, the bill, if passed, would not necessitate the making of the parts of machinery for the government to metric dimensions.

Dr. Stratton was followed by Mr. Southard, who stated that the bill was intended to give the system a trial in the government departments and that it did not involve compulsion.

Mr. Miller presented the longest of the replies to the paper. He considered that the system had spread in use because it is good. He referred to the experience of Willans & Robinson as showing that the English and metric systems could be used side by side without difficulty. He read opinions from many who had had experience with both systems and who preferred the metric and said that such conclusions showed that the system must possess strong advantages.

Mr. Christie read a long contribution explaining his own conversion to the system, and explaining the advantages of the system in calculation. Mr. Henning questioned many of the facts presented in the paper and read the testimony of a civil engineer, who had been in South America for several years and who testified that the system is thoroughly established there. Mr. Sharpe stated that the adoption of the system in business of the Brown & Sharpe Manufacturing Company would not help their foreign business at all.

In his closure of the debate Mr. Halsey asserted that the claims of Messrs. Southard and Stratton that the bill was not compulsory were of no account because they were not charged with its interpretation for the departments of the government, and that those having charge of government purchases could, and naturally would, interpret the law otherwise. Attacking their claim that the law would not apply to the parts of machinery made for the government and that the only thing contemplated is that the leading or capacity dimensions of existing machines be stated in metric equivalents, he asked if it was for this that the Congressional

Committee was holding hearings, that the Manufacturers' Association Committee, the Franklin Institute Committee and other engineering societies were making investigations, and likened such an outcome of all this turmoil to the mountain which in labor brought forth a mouse. He contended that the facts of his paper showing the imperfect adoption of the system in France and other metric countries had not been disproven, nor had his proof that the real effective adoption of the system necessitated the abandonment of all our existing mechanical standards, and this he insisted is the price which we are to pay for a trifling saving of time in calculations.

THURSDAY MORNING'S SESSION.

When Thursday morning's session opened, the metric question, which had been carried over from the preceding day, was resumed by the presentation of the report of what has come to be called the Metric Committee of the Society. This report was presented by Charles T. Porter. As a preamble it sets forth the views of the committee very strongly in favor of the continued use of the present standards, and is very strongly condemnatory of the metric system and of the law now before Congress, saying, among other things, that it was "conceived in ignorance."

Speaking to the motion for the adoption of the resolutions, Gus. C. Henning said he hoped they would not be adopted; that the case on the other side had not been investigated by the Society, and he thought it would be a great mistake for the Society to place itself on record in such a matter without a very careful, full and impartial investigation. Fred J. Miller said it seemed as though the discussion of the question was likely to be interminable. He thought the members had for the most part made up their minds upon the subject as well as they would be made up after a week more of argument, and to test the matter, as he said, he made a motion to lay the resolutions upon the table. As such a motion is not debatable and after an aye and no vote a rising vote was called for by Mr. Miller, the motion was carried by a vote of 36 to 32, and one of the most hotly contested and apparently most interesting contests to the members generally that has ever taken place in the Society was thus ended.

A resolution was then offered, based upon a suggestion made in the paper of Mr. James Christie read the day before and directing the Council to appoint three members to confer with members of other societies, such as the Civil Engineers, Mining Engineers, Electrical Engineers, New York Chamber of Commerce, etc., and to report upon the whole question after a careful investigation and comparison of views. This also was adopted by a rising vote of 34 to 29.

A resolution was also adopted offered by Mr. Towne, which was to the effect that since certain technical journals had misrepresented the Society's attitude in this matter, it was affirmed that the attitude that had at first been taken with regard to it had not been changed.

It was objected that the Society had, as a matter of fact, never taken any position with regard to the merits or demerits of the metric system, and that therefore there was no position of the Society to be stated or reaffirmed, but the resolution went through without serious opposition.

The meeting then passed to the consideration of professional papers, the first on the program being:

ENTROPY ANALYSIS OF THE OTTO CYCLE.

BY SIDNEY A. REEVE.

This paper calls attention to the advantages of submitting all heat engine records to the entropy analysis, the writer basing his remarks upon the tests submitted to the society by Professor Kerr in December, 1900. Several entropy diagrams are shown, and, in order to show that the fears of the burdensomeness of the process are exaggerated, the author gives at the conclusion of the paper a concise statement of the exact method of doing the work.

This was presented by the author, who sketched some diagrams upon the board, and, in answer to a question by H. H. Supplee, said he thought the action described would be the same with such an engine as the Deisel oil engine as with one operating by explosion at the beginning of the stroke, as in the Otto.

APPARATUS FOR OBTAINING A CONTINUOUS RECORD OF THE POSITION OF AN ENGINE GOVERNOR AND THE SPEED OF THE ENGINE WHICH IT IS GOVERNING.

BY J. C. RILEY.

This paper is intended to describe an apparatus for obtaining experimental data relative to the behavior of engine governors rather than results obtained with its use, although the results obtained on a McIntosh & Seymour engine are included. After stating the conditions to be met and the difficulties of the problem, the author gives an outline description of his apparatus as follows:

"It produces on a strip of paper, in parallel lines, so that they may be compared, an almost continuous record of the position of any part of the governor; a record of time intervals of any duration even to a small fraction of a second; a record of the angular position of the crank, as many times in one revolution as may be desired; and an automatic record of change in load on the engine, or any other event. The records are made by electrolytic decomposition of a chemical salt absorbed by the paper which is drawn under a series of recording styles while it is still damp. The solution used in this work was yellow prussiate of potash and ammonium nitrate in water. The passage of even a very weak current of the briefest imaginable duration, from the recording style (a piece of steel wire) through the paper, produces a clearly defined mark of Prussian blue. Chemical action takes place only while the current is passing, so that if the electrical circuit through any one of the styles is continually made and broken, the record produced is a series of short dashes separated by spaces whose length depends upon the speed of the paper. Time intervals are recorded by momentary closure of the circuit through one style by a seconds pendulum swinging through a globule of mercury; briefer intervals, by rapidly interrupting the current through another style by means of an electically driven tuning-fork. Provided the time intervals are short enough, uniform motion of the paper is not essential."

There was no discussion.

FLYWHEEL CAPACITY FOR ENGINE-DRIVEN ALTERNATORS.

BY WALTER L. SLICHTER.

This paper takes up a very live subject, the author pointing out that the direct connected alternating current generator is sensitive to instantaneous variations of speed in the engine in a manner which has no parallel with other types of apparatus. The paper is largely based on Mr. Astrom's paper which was read before the society at its meeting in Milwaukee last year, and some of Mr. Astrom's methods are reproduced. It is pointed out that experimental determination of the instantaneous variation in speed of an engine flywheel is a delicate experiment, which has met with but little success. Some of the methods which have been tried are briefly described.

H. E. Longwell presented a written discussion, in which he said finally that he could see no limit to the weight of flywheel that could be used to advantage, theoretically; but that in using very heavy wheels care would have to be taken to see that the wheel was running at its normal speed when switches were thrown in, to avoid the shocks that would result from the effort to change the rate of movement of heavy bodies suddenly.

HEAT RESISTANCE THE RECIPROCAL OF HEAT CONDUCTIVITY.

BY WM. KENT.

Mr. Kent suggests in this paper that the use of heat resistance is much more convenient than that of heat conductivity in connection with heat insulation, especially for cold storage warehouses. The chief advantage lies in the fact that in considering a number of substances acting in series, the resistance of the whole can be obtained by adding together that of the parts, while the conductivity cannot be so treated. The case is, as he points out, analogous to the case of electrical resistances. A table of conductivity and resistance for several insulating substances is presented, and the writer suggests that in future engineers who have occasion to

make tests involving heat transmission adopt a standard for expressing heat resistance. The subject is of large importance in connection with refrigerating work and the author hopes that future experimenters will report their results in the manner which he suggests.

There was no discussion.

A Forty-Four Foot Pit Lathe.

BY JOHN M. BARNAY.

This paper describes a lathe specially designed for the largest and heaviest electrical machinery and installed in the works of the Bullock Electric Company, of Cincinnati. The face-plate of the lathe is 30 feet in diameter, built in twelve segments and the drive is by a paper friction roll in contact with the rim of this face-plate, the power being supplied by a 75 horse-power electric motor. The estimated weight of cast iron in the lathe is 480,000 pounds. It swings 44 feet on the centers with a maximum width of 12 feet. The main bearing is 48 inches in diameter and the rear bearing 22 inches. The feed mechanism is driven by an independent motor. An outboard bearing is provided for long mandrels and boring bars. An interesting part of the installation was the providing of suitable foundations for the mass to be sustained.

The paper was not discussed, but the lathe was interesting to the members, and many questions were asked the author about it, in reply to which he said that the lathe had taken cuts at the rate of 64¼ cubic inches of iron per minute and that it was computed that to do this required the transmission, through the gearing, of 32½ horse-power; that the data given by Prof. Goss would indicate that such gearing could not transmit more than 1 1-12 horse-power. The motor driving the lathe could supply 75 horse-power at 750 turns per minute, and its speed is variable in the ratio of 1 to 7.3; the horse-power being variable directly in proportion to the speed. Mr. Supplee said that he felt quite certain that much higher duty could be gotten from paper friction drums than the rules laid down would give, as shown particularly in sawmill machinery, but he considered speed to be a very important feature.

Finer Screw Threads.

BY CHARLES T. PORTER.

Mr. Porter presents a scheme for an entire series of screw threads much finer than the present standard. The angle of 60 degrees is retained, but the sharp corners of the thread are rounded and filleted all to the same radius of .0045 inch. A table gives the threads for all sizes from ¼ inch to 6 inches, with various related particulars, diameters at bottom of thread, areas and relative increase of area. The number of threads to the inch is: For ¼ inch, 24 instead of 20; 1 inch, 16 instead of 8; 6 inches, 6 instead of 2¼. The percentages of increase of area at the bottom of the thread range from 11 per cent. to above 20. Diagrams also show the changes of thread angle with the change of pitch.

Mr. Christie said that in bridge work finer threads than those called for by the standard had been found advisable, as the standard threads showed too much tendency to work loose by vibration. It was the practice of the Pencoyd Iron Works, to make the threads on all bolts from 1½ to 6 inches diameter, uniformly 6-inch threads per inch.

Mr. Porter said he had never heard what the objection was to finer threads than the standard ones, and in reply to this Mr. Miller said he believed the adoption of the present standard was a compromise between many different considerations, and that it had been shown by experience that where a bolt or nut must be removed and replaced often, the thread, if fine, wore out much faster than if coarse, and that since some bolts finally fail in that way, that circumstance had to be taken into account, as well as the mere maximum strength of the bolt to resist a pull.

The Use of a Surveying Instrument in Machine Shop Practice.

BY CHARLES C. TYLER.

This interesting paper describes a special instrument and appurtenances employed in the machine shop operations incident to the building of eight 5,000-kilowatt generators for the Manhattan Railway Company, of New York, by the Westinghouse Electric & Manufacturing Company, of Pittsburgh. The stationary element, or armature, of each of these was made in six sections, the bore being approximately 34 feet. The revolving element, or field, consisted of many pieces, the diameter being 32 feet over all. For machining and assembling these, and also for the bed and yoke, a large floor-plate was first provided, 48 feet by 176 feet, and the actual work was done by large and powerful "portable" tools, while the setting, adjusting and testing were done by the instrument described. This was a dividing and leveling instrument of special construction and of minute accuracy, in connection with which was a center column for mounting the instrument, a center gage, a straight-edge, several specially ruled targets, a surface gage and other small tools. The paper describes in detail the operations involved in setting and machining several pieces of work. The arrangement has been in highly successful use for more than two years.

Much interest was shown in this paper, and it led to the relation of experience with engineers' transits, levels, etc., in the leveling and setting of shafting, engines and other machinery by Messrs. Fowler, Henning, Miller, Boyer, Christie and Sanguinetti. Many of these experiences had been had many years before, and it was this perhaps which led the author to think that an attempt had been made to show that the whole subject was ancient history. It was true, however, as he said in closing, that none of those who spoke cited cases wherein such an instrument had been used for locating portable tools for operation upon large pieces of work or where an accurately divided circle had been used for locating joints in built-up work.

Gift Propositions for Paying Workmen.

BY FRANK RICHARDS.

This paper is a direct attack upon the Premium Plan, the Bonus System and similar schemes for paying workmen. It deals principally with the premium plan, assuming that it has had the most extensive application, and works up a concrete example showing what the workman receives under day work, piece work and the premium plan. The writer's position is that the worker should be paid exactly according to the amount of work done, and for the last piece as much as for the first.

The paper brought out a great deal of discussion from those who favored the various systems criticised, and though little that would be new to our readers was brought out it was evident that there were many present who were staunch friends of the Premium System of Mr. Halsey and who do not hesitate to avow their adherence to it. In fact, Mr. Norris, of Cincinnati, said that if the author had taken the pains to study the Premium System and to make some comparative figures based upon it he thought that much of the paper would not have been written.

The Deflection of Beams by Graphics.

BY WILLIBALD TRINKS.

There is a growing recognition of the fact that machinery should be designed with a view to the rigidity of its parts rather than their mere strength. Unfortunately, however, while the calculations of strength are comparatively simple, those for stiffness are in many cases extremely complex and this paper is an explanation of graphical and semi-graphical methods which are, comparatively speaking, simple. Three such methods are shown, one of which involves the use of the planimeter.

There was no discussion.

As this was the last of the papers that had been set down for this session, and as there remained some time which could be used, it was devoted to the discussion of the first of the topical questions:

Smokeless Combustion.

Mr. Henning described the Langer system of smokeless combustion as in use in a large power plant in Vienna, where the requirements as to smokelessness were very strict and heavy penalties were inflicted for any violation of them. The essential feature of the system as described was a jet of mixed air and steam which was injected into the furnace. When this was stopped, as an experiment, smoke almost immediately began to issue and as promptly ceased upon the resumption of the jet.

E. P. Bates described some experiments

made in St. Louis after the passage there of a smoke ordinance. He said that in one case the owner of a plant had offered to give to the engineer all the coal he could save by smokeless firing. In this case no change was made in the furnace, but simply the engineer saw to it that the firing was done in a very different manner from what had previously prevailed. The coal was poor and it had been the practice to cover the entire fire with a deep filling of it at every firing. The furnace was of course very much reduced in temperature, and there was abundant smoke. The new method was to fire the coal in front and let it coke there and then push it to the back, supplying a little more in front to take its place. There was only a little gray color shown at the top of the stack—entirely unobjectionable, and the engineer received for saving coal about $14 per month over and above his regular wages.

VISITS TO POWER-HOUSES.

On Thursday afternoon a large number of members of the Society visited by invitation the three greatest power-houses of the city, those of the Manhattan Elevated Railroad, the Interurban Street Railway and the New York Edison Company, free tickets of transportation being furnished by the Interurban company upon those of its lines which were available. The members went at their own convenience within the specified hours, and as they arrived at either of the houses they were escorted in groups of six or eight by fully informed and courteous guides through the entire building, and everything was shown and explained as fully and freely as possible.

The annual President's reception was held as usual at Sherry's, Thursday evening, and in the language of Lincoln, for those who like that sort of thing it was the sort of thing which they like. In former years the Society has been imposed upon at these receptions, and, to avoid this, admission this year was strictly by ticket. As a result there was appreciably less crowding than in former years.

FRIDAY MORNING'S SESSION.

The session of Friday morning was opened promptly on time by the presentation of a paper on

Rotary Pumps.

BY JOHN T. WILKIN.

This paper has chiefly to do with the two-lobe cycloidal pump, with the construction and appliances of which the author is most familiar. While he advocates the use of rotary pumps for the purposes to which they are adapted, he protests against their misapplication, the latter having contributed largely to their unpopularity with engineers in recent years. When applied to elastic fluids this type of blower is specially adaptable to gas works, pneumatic tube transmission (either vacuum or pressure), foundry cupolas, smelting furnaces, knobbling fires, sand-blast, burning oil fuel, etc. It is out of place for differences of pressure of more than 5 pounds. The conditions upon which efficiency depends are specified and some instances are cited of the highly satisfactory use of this type of pump for the raising of water, one being mentioned with a capacity of 25,000 gallons per minute with a lift of 31 feet. As the delivery of the pumps while constant is not uniform, air chambers of considerable capacity are a necessary accompaniment.

The author placed on exhibition a model of his pump and read his paper in abstract only—a practice which, by the way, was followed at this meeting to a greater extent than heretofore, to the great relief of many. In the discussion Mr. Lane asked about the effect of scour on the working parts, to which the author replied that because the point of contact of the impellers is in constant motion the action is distributed over their surface. In the Southern rice fields, where the pumps are in large use, and where the water is clean, the scour is imperceptible after three or four seasons of work.

Professor Kingsbury asked for information regarding the superiority of the cycloidal impeller which the author uses over the involute form. He had looked upon the latter form as superior because, being truncated, a larger surface of contact was possible. To this the author replied that any curve which, like the involute, required to be truncated involves compression spaces like those of gear pumps. In pumping liquids at high speeds the action of the liquid in escaping from these spaces brings about a very severe scouring action from which the cycloidal form is free.

Mr. Henning asked if the one line of contact of the cycloidal form of impeller is sufficient for holding the water, to which the author pointed out that while the contact is mathematically a line only, the closeness of tangency of the curves is such as to give practically a surface of contact. Mr. McBride referred to the insufficient provision against end wear in most rotary pumps, to which the author replied that the form of his impellers gives ample surface.

The next paper to be taken up was

A Filing System for Office Use.

BY HENRY M. LANE.

This is an account of a system of filing catalogs and other matter which it is desirable to preserve for reference. The material to be preserved is filed as most convenient, according to size and shape, being all marked for shelf and section where it is located, and a complete card index being kept in the now familiar way.

The author explained that the system described was the result of several years of effort to perfect a system, and of the use of other plans. As compared with the Dewey system which he had tried, it had the advantage of a much smaller amount of vacant space and greater facility of reference. Mr. Fowler remarked that the system shown is substantially the one which he has in use. Mr. Crosby called attention to the fact that the usual letter file, by filing letters in accordance with their signatures, ignores their subject matter, and he considered a subject matter card index a very desirable addition to a letter file. Mr. Partridge stated that the proper rule regarding all files and indexes of this class for large establishments was to permit anyone to remove matter from them, but to allow but one person to replace it. Mr. Supplee explained a practice of the *Engineering Magazine* in connection with their Index of Engineering Literature, which is to serially number the backs of a set of cards with a numbering machine before sending them to the printer, to facilitate their rearrangement in case of their being "pied."

Following Mr. Lane's paper came

An Analysis of the Commercial Value of Water Power per Horse-Power per Annum.

BY A. F. NAGLE.

In this paper the author outlines the principles and methods which he has followed in estimating the value of water powers when streams have been diverted for the water supply of towns. He formulates his studies under three theorems, as follows:

Theorem 1. The value of water power, when of ample capacity for a specific purpose, does not exceed the cost of what a competing power (steam or gas engine) can be installed and operated for at the same locality.

Theorem 2. When a water power is insufficient for a specific purpose, due to the varying flow at different seasons of the year, and its limited amount, then its value is reduced from that established by Theorem 1, by the cost of (installing and) operating a steam plant to make good this insufficiency.

Theorem 3. The "damages" to be paid annually (or capitalized at — per cent. if made in one payment) for a given amount of diverted water power is the value of the water power as found by Theorem 2, plus the depreciation in the value of the remaining water power.

Mr. Rockwood contended that the author did not grasp the seriousness of the problem. He objected especially to Theorem 1 because the problem is to determine the actual value of the water power, not the value which it may not exceed. He objected that, in general, the author's statements are loose and convey only general impressions. The problem is, he explained, in all cases looked at from three different standpoints—those of the lawyer, the engineer and the business man, and of these the views of the last has always the greatest weight with the courts. He suggested that in place of calling upon the civil engineer for an estimate of the rainfall of the water shed the water wheel may be made to serve as a meter and thus determine the real amount of water used,

and he exhibited a photograph of an integrating instrument which had been worked up by Professor Charles Allen from suggestions of his own for continuously recording the amount of power developed by a wheel. The instrument records the effects due to varying gate openings, the varying head of water an' the varying efficiency for different gate openings. Mr. Lewis objected that the instrument took no account of the variation in the flow of water due to the obstruction of the wheel by anchor ice in winter.

The next paper to be taken up was

Centrifugal Machines and Their Uses.

BY BARTHOLOMEW VIOLA.

The writer goes but little into the theory of this interesting class of machines, confining himself to descriptions of machines in actual and general use and to the details which adapt them to widely different lines of service. The machines are used for separating juices, liquids, etc., from solids, liquids of different specific gravities from each other and for clarifying liquids or separating from them the contained inert matter. The most perplexing problem in the centrifugal machine is the balancing of the basket and its load. Provision must be made for permitting the rotating basket and its contents to find and adjust itself to its own center of gyration, and for this various devices have been employed, the machines treated of in the paper being of the Weston type, some driven from above and some of them from below the basket. The means of driving with the imperative conditions to be satisfied are treated of, and, besides the belted machines, those directly driven by steam engine, electric motor or Pelton water wheel are shown in numerous cuts. The paper is a valuable compendium of diverse information concerning centrifugal machines with little matter challenging discussion, and there was but little discussion. Mr. Kent objected that the formulas contain certain constants of which no values are given and without which the formulas have no value.

The next and concluding paper of the session was

A New Oil Testing Machine and Some of Its Results.

BY ALBERT KINGSBURY.

The two important properties of lubricating oils or greases are viscosity and body; these are discussed in the paper, and the machine described provides for the testing of lubricants for each of these properties independently. The machine resembles an upright drill in general appearance. The test journal has a vertical axis, and it is suspended from the spindle by a flexible coupling. It runs between two opposed bearings in a cylindrical case which may be filled with oil for the tests which require that condition. The load on the bearings is provided by a helical spring with screw adjustment and means for quickly applying or releasing the load. The case and attached parts are borne on a hollow vertical spindle turning freely in a sleeve supported from the frame of the machine. These suspended parts turn freely to a position where the torsion of the suspension wire balances the friction of the test journal and the angle of torsion is read from a graduated disk. Provision is made for a thermometer and also for heating by a Bunsen burner. Diagrams and explanations are given of numerous tests with interesting and valuable results; tables also are given of series of body tests of lard oils and engine oils.

The discussion was opened by a written communication from Dr. Thurston, who complimented the machine in the highest terms. He referred especially to the uniformity of the results and to the phenomenally low coefficients of friction obtained, as well as to the fact that in the use of the machine but one condition was varied at a time. To this the author replied that the results are due to the vertical position of the spindle, which permits oil bath lubrication, and to the fine fitting of the acting surfaces.

Following the reading of papers, the topical discussions in relation to which several contributions in print had been distributed with the papers were taken up. The first of these related to the question:

Has any term ever been suggested to discriminate between the elastic resistance offered by a body to a force tending to change its shape and that offered by the same body to a force tending to change its volume? How much of the latter kind of elasticity has India rubber?

To this Mr. Miller had contributed some remarks based on a piece of experience with a rubber spring which was enclosed in a closely fitting iron shell and which, in consequence, possessed no elasticity. When a helical spring was subsituted for the rubber spring, the difficulties vanished. Mr. Henning remarked that all solids were incompressible and noted the common error in the use of language by which what are properly thrust tests are called compression tests. Mr. Hale noted the two kinds of elasticity, of which the one due to change of form he called shearing elasticity. He noted the difference between the common and scientific ideas upon the subject, among them the fact that substances which in common language are the most elastic are in scientific language the least so. Mr. Supplee called attention to a form of tube expander which utilized the incompressibility of rubber. The action is very like that of an hydraulic press, the rubber taking the place of water, and the chief difference being that the rubber requires no packing. Mr. F. H. Richards stated that it is practically impossible to obtain rubber which did not contain air bubbles, the action of which is to give a false appearance of change of volume. He had examined hundreds of specimens with a microscope and had found none which did not contain air bubbles.

The next topical discussion was upon the question, "What has been your experience with oil burners?" Mr. Wilcox stated that the Southern California division of the Santa Fé Railroad burn on all their locomotives crude oil having an asphaltum base which costs one dollar per barrel. The appliances used are described in some detail. Mr. Arnold considered that the essential factors in an oil burner which should not produce smoke when used under steam boilers were complete atomization of the oil and complete combustion before the products of combustion entered the tubes. Professor Williston had found little or no difference between different kinds of burners. He considered that the essential features for the successful burning of oil lay in the furnace and not in the burner. Heated air should be admitted freely to the furnace. He promised to supply drawings of a successful furnace. Economically it is seldom that oil is cheaper than coal. The increased insurance rates alone usually prohibit its use. He considered that one of the best applications of oil fuel to boilers was in connection with soft coal. A small supplementary oil fire will maintain the temperature of the furnace at a point which will prevent the production of smoke by the coal. Much interest was shown in this statement and fuller particulars were asked for. Other speakers corroborated the statement that there was little difference in burners and that the real problem lay with the furnace, as well as the one that a small supplementary oil fire would suppress smoke from soft coal. Mr. Wilkins called attention to the amount of steam required for atomizing the oil and stated that an air jet at low pressure was much more economical than steam. Mr. Supplee called atention to the large amount of information on this subject which is contained in the last report of Admiral Melville.

The next subject was Separating Oil from Exhaust Steam. In a written discussion Mr. Yaryan called attention to a separator described at page 945, Vol. XXI, of the Transactions as an entirely satisfactory device. Mr. Ekstrand had found that with all devices the amount of oil that can be separated decreases as the temperature of the steam increases. He had described all the separators which are offered for sale and had adopted tanks filled with charcoal, coke, hay or other filtering material, which he has found entirely satisfactory. Mr. D. J. Lewis stated that it is essential that the baffle plates of separators using them should be periodically cleaned by boiling in a solution of soda and potash. New separators work well for a time and then fail, but their original efficiency can be restored in this manner. Mr. Bates had had little trouble in separating oil from the exhaust of ordinary engines, but had found it impossible to treat the ex-

haust of Westinghouse engines successfully. The oil and water in the crank case appear to form an emulsion which reaches the exhaust through the packing and which the separator will not treat successfully. To this Mr. Lewis replied that with the Westinghouse engine it was necessary to clean the plates about twice as often as with other engines and that with this precaution the difficulties vanished. He remarked also that the separator should, for the best results, be placed between the engine and the feed water heater.

The last topical discussion was upon the subject of Tempering and Annealing Steel.

In a written discussion Mr. H. P. Jones referred to the controversy between producer and consumer as to which should anneal tool steel and to the injury to the steel by contact with the furnace gases when heating. Apart from surface oxidation he considered this to be of little importance. He described methods which he had followed with much success in annealing tool steel. Mr. Markham referred to experiments which he had made to determine the temperature at which annealing effects begin and considered this to be at about 175 degrees Fahr. He distinguished between brittleness and hardness and believed that they were not affected alike. Mr. Oberlin Smith considered the hardening effect to be due to the suddenness of the cooling and that this explained why oil would harden small masses, but not large ones. The conductivity of the oil is sufficient to reduce the temperature of small pieces with sufficient suddenness, while it is not sufficient if the pieces are large. Some high carbon steels in large masses require a heavy stream of water to harden properly, although in small pieces they will harden by simply plunging. Mr. W. S. Rogers related an experience in which a lot of hardened work had been rejected by a government inspector because, under the microscope, it showed incipient fire or hardening cracks. He sketched upon the blackboard a hardening tank which he had found described in some papers left by the late Geo. F. Simmonds and which had completely overcome the difficulty. The tank was rectangular and had a partial partition across it extending from the top to a few inches below the surface of the brine. On one side of this partition oil was floated on the top of the brine. The articles to be hardened were placed in a wire basket with a long handle and were plunged into the side which did not have the oil. The basket and its contents—still submerged—were then carried across the tank and raised by the handle until the basket was within the mass of oil. Mr. Woolson remarked that cutlery manufacturers in order to vary the temper of their products maintained all conditions constant except the degree of heat to which the blades were raised.

This completed the discussions, and Secretary Hutton, referring to a decision of the Council that monthly reunions be held at the Society house during the coming winter, stated that while the date of the first one had not been determined, the subject for discussion would be the integrating apparatus for water wheels, which had been described by Mr. Rockwood in the discussion of Mr. Nagle's paper. He also asked for authority to prepare the usual set of resolutions of thanks for those who had contributed to the success of the meeting, which was granted.

Mr. Kent then arose and stated that the position in which the action of the Society in tabling the resolutions of the Metric System Committee had left that matter was unsatisfactory to many, and offered some resolutions directing the Council to submit the matter to a mail ballot among the members. Mr. Miller offered as an amendment that the paper by Mr. Halsey and the discussion on it be put in permanent form in type and be distributed among the entire membership at the time the vote is asked for. The resolution led to some vigorous discussion. The tradition of the Society against endorsing anything was appealed to, and in reply Mr. Halsey stated that he had no doubt the tabling of the resolutions of the committee would be misunderstood at Washington, as the action taken last spring had been, and that it would assist the passage of the measure.

Mr. Miller said that misunderstandings by those who would not take the trouble to look up the records were unavoidable. Nevertheless he believed it was right that the members of the Society, who were almost infinitely more interested in standards of measurement than the members of any other engineering association, should express their individual opinions upon it. The resolution was adopted without serious opposition.

Echoes from the Oil Country.

Among the responsibilities that fall to the lot of the man running a country job shop is the one of determining just what to do on a job. Sometimes the job is hardly able to stand the necessary repairs; at other times the owner may want some things done and not want others really more important. Occasionally the orders will be to fix something already good enough, while another part that needs fixing will not be mentioned. Of course if everything does not go satisfactorily the shop is held to blame, and at least suffers in reputation, if not blessed with a row, before the bill is paid.

If there is a place on the earth that needs a variety of foremen with diverse gifts worse than the general job shop I do not know where to find it; not just now at least. If all the other shops go to getting them I suppose we will be compelled to fall in line and do the same. As it is now, every man has to be a mixture of most of them, while the "boss" has to have some of all of them and some of a whole lot more kinds that are needed in the office and drawing-room. No wonder some of us have such small quantities of some of the ingredients.

If a man had to put some of all the elements into a quart cup he would hardly expect to have a full quart of any one of them, yet if that quart cup was the only place he had to put them and he wanted some of each, he would have to put up with it or get more cups. Some men have a faculty of packing more into their cup than others and of packing it in such a way that they can always get it out at short notice when wanted and make it go a good ways when they do get it out. Those are the best we can get at present, although we like to have an idea as to what elements predominate.

The fellow that can do *everything some way* is bigger potatoes and more in a hill with us than the one that is a world beater at one thing and good for nothing else, even if some of his ways are about as poor as ways can be; because, on short jobs, it often takes less time to push a job through by the first way thought of than it does to find out the best way, and a man who thinks of *a* way can generally do it that way, while it might be hard to explain and get him to understand and do it the *best* way. Just as a poor tool in the hands of a friend may do better than a good one in the hands of one who is not a friend to it.

The man pushed that old drill press too hard and the belt came off. It was quite a ways from the line shaft to the bottom of the drill press and the belt seemed tight enough when put on without being crossed, even if it did run the drill backward.

It may seem odd to you that a man would try to make a drill cut running backward, but put a man in a place where he feels he does not belong and let him know that he is doing very poor work and very little of it, and he is apt to lose his head and do all sorts of absurd things.

After getting the drill in such shape that a lot of grinding was necessary, the man went to the grind-stone and a cub came along with a piece he had to drill a hole in. This cub didn't know much about machine shops or drill presses, or anything else mechanical, for that matter. It didn't seem odd to him to find that press running backward (although the other one ran the other way). When his drill wouldn't cut (a flat one, fortunately), he slipped over to the back side of the grind-stone and ground it the other way and had his hole drilled and was gone before the man returned. He wanted a hole in that piece and he got one in.

The boy had to produce the drill he had used to show he was honest in his part of it, while the man never succeeded in convincing anyone that he was a jobbing hand, even if he *had* tried that drill both hard and easy, fast and slow, while he

was burning the end off it with the press running backward.

He had taken the drill to the foreman as proof that the stock was too hard to be drilled, without knowing what was wrong. Blaming someone for changing the belt hardly established his reputation as a mechanic.

That boy had in him the making of a good jobbing hand. Results were what he was after.

"Here, Tommy, patch this piece. Do the best you can; I haven't time to show you anything or help you just now. A man's waiting for the job over there and I must finish it."

A half hour later and Tommy was still staring at the job blankly, without having make a start.

"Hello, lad, why don't you push that job along?"

"I couldn't think of the best way to get at it."

"What did you wait for the best way for? 'Most any way is ahead of doing nothing. You should have had it done by this time."

"Well I—I couldn't think of *any* way to do it."

"Why didn't you drill a couple of holes in a piece of iron and mark the broken pieces, or clamp the iron and the pieces together and drill through both, or drill and rivet the iron to one side and then do the other side, or drill up the casting and then mark off the patch?"

"It's awful easy for you to talk and tell all of these things. You know all these things because you're the boss."

"I suppose you think someone stuffed the knowledge of these things down my throat, like I've seen country people stuffing turkeys they were fattening. *Knowing* things may make a machinist out of you some day, but being a machinist or a 'boss' either won't make you know things."

On the ordinary jobs that come up a good jobbing hand does not like to have the foreman tell him how he must do a job. He generally has ideas of his own, and as long as his results are good it is a good plan to let him use them. By saving the foreman's time planning, his way will pay, even if not quite as speedy as some other ways.

I see mention several times lately of the combination of jobbing and manufacturing, which shows that others are wading through some of the same experiences that I have had. I have some very strong opinions on these subjects, and feel confident that those who have worked and planned over the same ground will be found sharing them with me. In running a job shop I have always found it necessary to have something to fall back on, to fill in the time with. We have bought and repaired old engines and pumps, built new engines, run a junk yard and rebuilt or repaired anything worth it that came in to us among the old stuff.

If you call that kind of work manufacturing, then I would give a rule as follows: "When running a shop on job work *always have something* on hand to manufacture as you have opportunity."

This is a very good rule, and a little examination will show that it, or one very much like it, is in very general use among successful job shops, but it will also be found that sometimes something that at one time has been used to fill in gets to be in such demand that a regular business is built up.

When this business gets to where it is really manufacturing, then another condition of affairs has to be provided for, and under these conditions the problem can best be worked by a different rule.

My rule for such a state of affairs is this: "When manufacturing, *never* do a bit more jobbing than you nave to."

To the man who has "been there" these rules do not need any explanation, and most of those with shop experience can understand the former one without trouble. The latter one may not be so clear; but let us see how things work.

Just imagine you are in a shop building "corn-shellers." We have one blacksmith. All he has to do is to keep up all of our tools and repairs and the same for the foundry, and do the forgings for the corn-shellers. There isn't work enough for two blacksmiths, but really too much for one; yet by dint of hard work he manages to squeeze along.

Now here comes a little job. The whole job might be worth $5, or perhaps $6; but there is about two hours of blacksmith work necessary, and the rest of it would take my very best man who does my fine work.

A job shop that can make one and a half dollars real profit on that size job is a good one, but even if it was all profit I would still be a loser. To come out even on that job, I would pretty nearly have had to charge all the time and expense of us all on that job, and then wouldn't the fur have flown when I tried to get the pay for it; but consider a little. Is there any reader who can do the jobbing with the least valuable men and with the tools that have the least to do in his shop? If there is, he should make himself known, for he certainly deserves both riches and fame. Or is there one who keeps his real good jobbing hands on unimportant work, so that they can be used on these "outside" jobs whenever wanted? If so, who pays for the difference between what they are worth on that and what they would be worth at their best?

Another thing about jobbing: It is nearly always in a hurry—I knew a job that wasn't, once; but that belongs in another place—and has to have the right of way. In a small shop it has to go to the tools that will handle it, without regard to whether the men running them are competent to handle it or not. If not, someone else must be put on, or else the foreman has to stay by it. How would you like to collect for two men's time on a lathe on a job when the owner of the job will "kick" for 45 cents an hour if you charge him 50 cents?

A jobbing shop can do lots of work for filling in that are not "jobs," and generally has to do it to make both ends meet; but if there is a real *manufacturing* shop in this country that "hankers" after the regular run of jobs that come to a job shop in this section, I would very much like to know where it is, as I shall surely put it on my calling list.

Don't confuse the "contract" shop that takes contracts for all sorts of big jobs with our "jobbing" shops, where things will run about like this:

"Bore out this cylinder and put in a new bull ring and a couple of snap rings."

"All right; you can have it to-morrow morning."

"How much will it cost to put a handle on this coffee mill?" "Twenty cents, and it will be ready in half an hour."

"I want a new brass 'liner' on this pump plunger and I want to take it out with me after dinner." "It will be ready by 2 o'clock."

"Say, Mister, can you grind these skates for me right away?" "Sure, sonny." "And then grind up these shears and this butcher knife. I'll get *them* after 'while."

"Send a man up Calaboose run quick. That confounded water pump that is supplying the drillers is bucking, and they cost me $14 a day, and I've got to get the water to them. I want a man that knows something, and tell him to fly getting there; he can walk coming back." "I'll send you Tom; he's a thoroughbred."

"I want a casting off from these pieces and then want it fit up. Can you get it in to-day?"

"That is a pretty bad smash up, but if you didn't lose any of the pieces I guess we can manage it. Here, Sammy, get a pair of tongs and hold these pieces under the boiler and burn the grease off, then take them to the foundry. Better count the pieces, so you won't lose any. Yes, that's right; just eleven pieces."

"No, we don't shoe horses or oxen. There is a shop that shoes horses up there a ways; I'm not sure about the oxen."

"So your lawn mower has gone on strike; well, it's $1.25 for general overhauling, or 75 cents for grinding and adjusting. You can get it to-morrow."

"Here Johnny, drill this pipe full of holes for the refinery. Put in 3-16 inch holes, about an inch apart. It will take about 1,800 holes, so jam them through."

"Come, boys, all lend a hand to get this plunger in; look out a little; that is solid." You can figure some time what a piece 10 inches diameter and 5 feet long would weigh.

"Walter, get the 28-inch lathe ready; we want to run a cut over it while the team waits. It is shutting down their wax press."

"We will either grind your axe for you or let you grind it. Very well, it will be ready in an hour."

"It will take about four days to give your engine general repairs, unless some parts are broken that we will have to make patterns for."

"Get that boiler front in from the foundry and fit on the doors and give it a coat of coal tar."

"Two dozen brass springs, No. 4 wire, 4½ inches long, 1⅛ inches inside, for the high-pressure pump; same as the last ones. Yes, I have the wire, and you can get them as you go to work to-morrow night."

"You don't know where that washing machine was made, eh? Well, you won't have to throw it away for want of that piece. Leave it here and come around again before next wash day."

"I haven't such a saw arbor as that on hand, but I have a couple of pieces that will do for collars, and I can soon have you one. You might as well get the boxes and track here, too, while you're at it. Iron ones are lots better than wood. They stay in shape better."

"So that old hydraulic jack needs new cups again. I'm ready for you this time; made two sets the last time. It won't take long to get them in. I'll look at the valves when I have her apart. You may have been feeding her sticks again."

"No, all that 8-inch pipe isn't ready yet. It isn't quite as quick threading pipe in a lathe as it is in a pipe machine, but we are pushing it along."

"If you want the full outfit of cranks, flanges and shaft, bolts, wrist pins, swivel stirrups, strain rods, etc., it will use up two or three weeks; but that will be as soon as you can get your timbers framed and ready. I won't keep you waiting. Let me get exact sizes before you go."

"Tell Dick to get the rolls out and the babbitt out of the boxes and I will have a man there by the time he is ready. Oh, well, if he wants me to do it all, I will send a man right away, if he is willing to shut the mill down."

These are only a few of the kinds of jobs that come in, but will show what it would mean in a nice, clean, orderly shop doing a regular line of manufacturing.

W. OSBORNE.

A New Power Hack Saw.

The half-tone illustrates a power hack saw in which are combined a number of interesting features. The machine is very compact, the connecting or driving rod being carried at the back of the saw frame, and as both frame and saw blade are rigidly guided, the latter has no chance to "run" and the stock is cut off true.

The frame for the saw slides on a horizontal guide secured to a sleeve which can move up and down on a post firmly fixed in the bed plate at the side of the vise. The horizontal guide is provided at the back end with a socket, which slips over a second post, and is thus kept from turning with its sleeve about the main post upon which it is mounted.

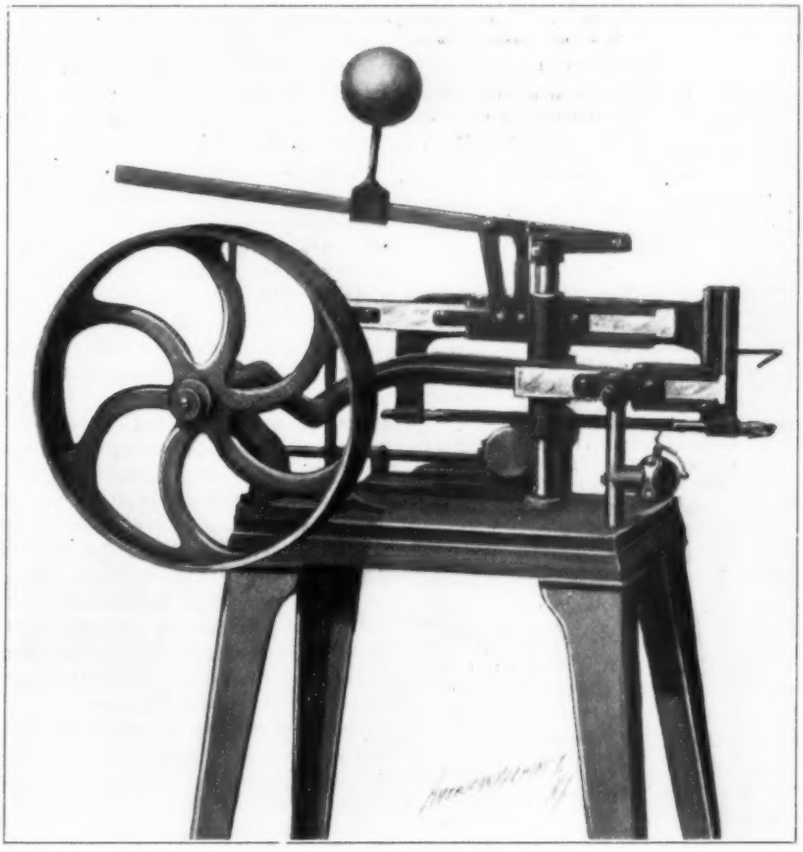
The connecting rod, for moving the saw back and forth, is actuated by a crank on the driving shaft, and attached to a head which travels on a guide placed parallel with the saw frame. The frame is provided with a vertical slot to receive a projection formed on the sliding head, and thus, while the head always remains at a certain hight, the saw can feed down into the work. The driving pulley, belted direct from the main line, has a clutch which may be thrown in and out by a small lever shown at the side of the driving shaft bracket.

The feed for the saw is by means of the weighted lever at the top, the weight being placed at any desired point on the arm. The ball which forms the weight is released or clamped by simply giving it a turn with the hand. When the saw has finished the cut a bell rings until the driving clutch is thrown out, or the frame lifted (by means of the lever at the top) for another cut.

The saw guide is of hardened tool steel. It has a slot just wide enough to receive the blade, and, as it is adjustable in all directions and mounted at the front of the sleeve which carries the frame, it is always close to the work and prevents the saw from springing or twisting in the cut. One of the studs—at the end of the frame—upon which the blade is hooked is provided with a guide pin, which keeps the blade from turning while it is being drawn up tight by the thumb-nut.

The vise for holding the stock swivels, and is graduated so that it may be conveniently set at different angles.

The saw is made in three sizes. The No. 1 takes a 6-inch blade and handles stock up to 2 inches in diameter or 2 inches square; the No. 2 uses a 9-inch blade and cuts stock up to 3 inches, and the No. 3 takes a 12-inch blade and handles stock of any size up to 4½ inches.



NEW POWER HACK SAW.

L. H. Olmstead, of Hasbrouck Heights, N. J., is the manufacturer.

An English Safety Lamp.

A prize of $250 has been offered in England for a "safety" kerosene lamp. The lamp is not to cost more than about 30 cents at wholesale. The following were among the requirements enumerated:

"They did not require a lamp which needed the inventor sold with it in order to enable it to act; they wanted to find a lamp that would be safe when a man came home drunk at night. One of the most serious problems of London was as to how they could protect those diseased with drunkenness against themselves. Therefore they wanted to find a lamp which if thrown by a drunken man at his wife or children would automatically put itself out, so that the man, if he unfortunately inflicted any injury on his wife, should not, at the same time, burn down his house and set fire to his children."

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Annual Meeting of the Mechanical Engineers.

In this issue we present our report, as full as our space will permit, of the recent annual meeting in this city of the American Society of Mechanical Engineers. The meeting was in several respects different from any which has preceded it, and at least two circumstances of the meeting were unusually welcome, although at the same time they were the direct results, the one of an unwise practice and the other of an unfortunate condition of the Society. As these factors in this case wrought temporarily for the good of the body, may we not hope that permanent good also may come out of their unwelcome stimulus?

The first of the circumstances here alluded to was in having throughout the meeting the services of a most admirable and every way efficient presiding officer. In the selection of its president, each usually serving for a single year, the Society has constantly sought to accomplish two most desirable but generally incompatible results. It has sought to honor itself by selecting each time the man most eminent in the profession and most deserving of the highest professional appreciation, and at the same time it has of course at least desired to secure one who would capably fulfill the responsible duties of the office. The capable, eminent and deserving engineer was unerringly selected at the preceding annual meeting, but his much regretted illness made it impossible for him to attend, and to this circumstance we are indebted for the most gratifying work of Vice-President Waitt. It is to be hoped that in the future selections of its presidents the Society will never forget its own urgent need of efficient and faithful service. It is gratifying to be able to fully believe that in the man whose election was announced at this meeting the Society certainly put the right man in the right place.

The other happy circumstance of the meeting, also begotten of prevailing untoward conditions, was the use for the principal sessions of a room of adequate size and of otherwise not unsatisfactory conditions. It may be considered certain that whatever happens the members will never again consent to gathering in the old house for the important functions in which it is the duty of the entire membership as far as possible to participate. The comfortable luncheon service made possible by the change in the place of meeting will be remembered with pleasure instead of regret by all who were able to avail themselves of it.

As to what was said and done at the meeting there is little that need be considered here. Matters seriously affecting the future standing and progress of the Society were discussed with perfect freedom, with perfect good feeling and with an evident desire on the part of all who participated to do what was best for the permanent good, and we may continue to hopefully work toward the righting of everything that now hinders and hampers the useful activity of the Society. At the successive meetings of the Society there came up for consideration matters which when clearly stated at once cause expressions of wonder that they have not been looked into before, and one of these to which considerable, and, as some may have thought, a disproportionate portion of time was given at the business session was the status of the Junior member of the Society. Suggestions to be embodied in the future recommendations of the Council constituted the extent of the action taken, but it may be expected to result in taking the Junior membership out of its anomalous position and to add to the revenues of the Society.

Probably all will be willing to agree that in the technical discussions of the meeting abnormal prominence was given to the discussion of the metric system, or rather to the proposed action of Congress with regard to its adoption, and much more time was taken up by it than its actual importance should have warranted.

The technical papers presented at the meeting were not below the average in interest or value, but they perhaps were not of such a debatable character as some that have been presented, and the opportunity for discussion was closely restricted by the shortness of time allowed, notwithstanding the unscheduled session of Wednesday afternoon. The little time that was permitted for the discussion of topical questions was still sufficient to indicate the interest and profit that would be found in their larger employment.

The Meaning of the Action of the A. S. M. E. on the Metric Question.

The action of the American Society of Mechanical Engineers last week in regard to the proposed metric legislation now before Congress is sure to be taken by some as action endorsing the metric system. It is unnecessary to inform anyone who followed the matter carefully that it was nothing of the kind, but that will probably make little difference to those who wish to believe that the Society favors the metric system and to use that assumption in their propaganda. It is the common misfortune of societies and of individuals, who attempt to do anything of importance, to be misunderstood—especially by those who are blinded by prejudice or extreme partisanship. As a matter of fact, the Society, by its vote upon the resolutions of the Metric Committee, simply declined to go on record as opposed to a certain bill now before Congress, which bill is advocated by those who favor the metric system or who believe the bill offers a fair and safe method of testing the system without injury to anyone.

There will be those who will say that the refusal of the Society to condemn the proposed law is practically the same as an endorsement of that law; but anyone who

will take the trouble to look into the matter will find that that is by no means true.

The Society has from the first, and always, declined to commit itself, as a Society, with regard to any such measure, either for or against it. Even in matters of strictly engineering import it has refused to commit itself to the opinions or reports of its own committees. Such reports as that relating to Standard Methods of Conducting Boiler Tests, Standard Methods of Conducting Engine Tests, etc., have always been simply received, placed on file and printed in the Society's Transactions; but no one using them is justified in saying that his procedure is that which has been laid down as the proper one by the A. S. M. E. as a society. All that can be claimed is that they are methods which have been adopted by committees of the Society appointed for the purpose and that they have been thoroughly discussed by experts previous to adoption by such committees.

Declining to attempt to lay down laws in such matters regarding which it might be supposed to be fully competent, it would obviously be the hight of impropriety for the Society to commit itself in other matters, such as proposed legislation, etc., and as a matter of fact it has always, as the records show, refused to do so. It has been made clear on numerous occasions that the majority of the members believe it is wise for the Society to continue in this course, and it is probable that many of those who voted to table the resolutions of the Metric Committee violently condemning the pending bill would also have voted against a resolution endorsing the bill.

The facts are, as the records show, that the Metric Committee was not appointed to formulate resolutions expressing the sentiments of the Society with regard to the metric system and much less to oppose pending legislation. It was appointed to do just one thing and no other, *i. e.*, to gather material or data which might be used in an effort to prevent the forced introduction of the metric system in case it were needed. The committee, so far as we are aware, has never done that which the records show it was appointed to do. But, instead of this, certain members of it have opposed the bill now pending before Congress in such a way as to make it appear that they were acting for the Society and expressing its views. There can be no doubt that this was a misrepresentation of the Society, and it was this, and nothing else, that was disapproved by the action of the Society at the Boston meeting. The record shows all this to be exactly true, and from it the fact is clear that two misunderstandings have previously arisen with regard to the matter: First, it was assumed by many that the Society had expressed itself as opposed to the metric system; second, it was assumed that the vote at the Boston meeting was a reversal of the Society's position and was in favor of the metric system. Both of these assumptions are very wide of the facts.

No one doubts that could the matter be voted upon by the Society there would be a practically unanimous vote opposed to the forcible introduction of the metric system into American machine shops or engineering establishments, and if the committee would only stick to its text and gather material to be used if necessary to oppose such forcible introduction, few, if any, members of the Society would object and most of them would undoubtedly approve; but this is a very different thing from bringing in and attempting to have passed resolutions couched in the most intemperate language condemning a bill which those who have it in charge declare is not intended to force such use and will not; this opinion being sustained by a carefully drawn opinion of the Attorney-General of the United States and absolutely without any legal opinion to the contrary.

If there were any vested or financial interests behind the present bill, or if the question of partisan politics entered into it, then the claims made in its behalf, and especially with regard to its import and final effect, would properly receive very close scrutiny. But no political party nor pecuniary interest has, so far as anyone can see, had anything to do with it, and until we have opinions to the contrary much more weighty than those based upon examinations by engineers of the dictionary definition of the word "the" we may obviously take the carefully prepared opinion of such a well-known and prominent lawyer as is Attorney-General Knox regarding the import and effect of the bill. That is what eminent lawyers are for, and is the work for which they receive high fees. Mechanical engineers are qualified for entirely different work, and would do well to stick to it. They know better than anyone can tell them what system of measurements will best suit their purposes, but such a lawyer as Attorney-General Knox knows much better than any engineer can tell him what is the proper and correct interpretation of proposed legislation.

The recent action of the Society is therefore not to be taken as an endorsement of either the metric system or of the proposed law. It is nothing more than a declination to place itself on record as opposed to the said law; and what the members generally think of this law will probably be ascertained as a result of the resolution adopted at the final session providing for the distribution to the membership of Mr. Halsey's paper and the discussion upon it, and requesting members to record their sentiments upon it. This is in accord with the traditions of the Society, and there can be no proper objection to it.

Some New Things.

THE MEANOMETER.

The meanometer is a neat form of boxwood rule, especially designed for computing the mean pressure from indicator diagrams. The scale on one side is divided, so as to quickly mark off on the diagram the middle ordinates of the usually ten divisions; and the slide on the opposite face is used to integrate the various pressures. This instrument is made by Messrs. Barrow & Harding, 6 Laburnam street, West Hartlepool, England.—*The Practical Engineer.*

MAGNETIC T-SQUARE.

A "magnetic" drawing-board and T-square is being introduced by Messrs. W. T. Ellison & Co., Limited, of Irlams-o'-th'-Height, Manchester. The board in question is fitted with a rubbing-strip of soft iron along the working edge, while the T-square has a number of small horseshoe magnets let into the stock, which are attracted by the iron strip aforementioned, and make the square cling to the board. The draftsman can therefore have both hands at liberty for his work, without requiring to use one to steady his T-square. The boards and squares are made in all the usual standard engineering sizes. The iron strip, we may add, is ground to a true surface, and the T-squares are made of mahogany.—*Engineering.*

Technical Publications.

"Metallurgical Laboratory Notes." By H. M. Howe. 140 6x9-inch pages, with 44 illustrations. The Boston Testing Laboratories, Boston, Mass. Price, $2.50.

The author of this book objects to the usual scheme of metallurgical laboratory instruction, and aims at teaching individual underlying principles rather than individual processes. His method is carried out by a series of distinct experiments, each of which tests one or more of these underlying principles. The book is too much without the field with which we are acquainted for us to form an estimate of it which would have any value. The reputation of the author is, however, such as to command respect for anything which he may do.

"Manuel du Chauffeur-Mécanicien et du Propriétaire d'Appareils a Vapeur." By Henri Mathieu, Controleur Principal des Mines, Inspecteur des Appareils à Vapeur de la Seine, etc. Second edition. Pp., 892, 6¼x9¼ inches. Ills., 716. Paris: Librairie Polytechnique Ch. Béranger, 15 Rue des Saint-Pères. Price, 25 francs.

This work which, having stood the test of ten years, now appears in a new edition, is pre-eminently a treatise for practical men. It embraces boilers, engines, furnaces, combustibles, safety valves, feed water apparatus, explosions and a great many other things, describing them with hardly any use of algebra. In short, it is the sort of book that will appeal to the

overall engineer or machinist who wants to post himself extensively on engineering topics, but has not the foundation for appreciating a deeply scientific treatise. It seems to be written to a considerable extent for the purpose of educating engineers and owners of plants in the principles conducive to safety. But we do not mean to classify it as merely a rudimentary book. Its copious descriptions of steam power appliances render it a valuable reference work for any engineering library.

Shocking Killing of a Boy by Compressed Air.

Perhaps the most unspeakably horrible and atrocious thing which it ever came in the line of our duty to speak of, was the killing of a thirteen-year-old boy by his young shopmates at the American Locomotive Works, South Paterson, N. J., on December 4. The lad was a new employee and was being "initiated," as is a quite common practice, under which the subject is made the victim of any prank the moment may suggest. As in any such establishment, there is a constant supply of compressed air usually maintained at a pressure of 80 to 100 pounds with attached hose and nozzles for blowing away dust and chips and other uses. The boys applied the hose to the body of the victim and turned on the pressure, with the result of rupturing the intestines, and the boy died after lingering in agony for two or three hours. It would seem to be impossible and useless to comment upon the occurrence.

Notes on Crane Design—Errata.

In Mr. Williams's article under the above heading, published at page 1710, the following corrections should be made: In the first column of page 1711 and in the line immediately over the diagram, the word "desirable" should read "undesirable." The second and third sentences of the last paragraph of the article should read: "Each additional motor on the trolley requires three more trolley wires and a controller. If shunt solenoids are used one trolley wire must be added, and the hoist controller would have special contacts for it."

Considerable comment has been caused by the fact that at the recent meeting of the American Society of Mechanical Engineers three of the editors of this paper were on opposite sides of two questions that were discussed, and some have wondered at this. The explanation is, however, very simple. Though the AMERICAN MACHINIST has an editor who directs its editorial policy, he does not require nor expect that men with brains enough to be of any use as associate editors on such a paper will always agree with his opinions about everything. Freedom of thought is the only condition under which there can possibly be any thought whatever that is worth anything.

Second-Hand Machinery.

The *Boston Journal of Commerce* says that there are a number of Southern cotton mills that do not pay, and the words of a prominent manufacturer are quoted in explanation of the cause. The lesson conveyed is one of far wider application than to Southern cotton mills. Some machine shops, variously located, might find a lesson in the following words:

"I do not believe that any mill ever made anything by purchasing machinery that had been discarded by other mills. I remember a particular case which will serve as an illustration of the point I am making. A Southern mill man purchased his spinning machinery from a New England mill. The Southern manager was not a practical mill man, but he thought he was making a fine business deal when he purchased the machinery at a fourth of the price he would have had to pay a builder. When the machinery was put in operation it was found impossible to get off the production aimed at, while the goods produced were of an inferior quality and brought a low price. When the superintendent resigned to save his reputation, a light began to dawn on the manager, causing him to doubt whether he had executed such a fine stroke of business, after all."

Personal.

It is gratifying to be able to inform our readers that Mr. Edwin Reynolds, whose term of office as president of the American Society of Mechanical Engineers has just expired, and who was unable to attend the recent annual meeting of the Society, as also the Boston meeting, is in greatly improved health and has returned to active participation in the business of the Allis-Chalmers Company.

The University of Illinois has received a Brown & Sharpe automatic gear cutter fully equipped with a set of cutters and other appurtenances as an enduring memorial of a former student and graduate of the institution, Edward A. Adams. The gift is made by a sister and other members of his family. The choice of the gift is to be commended to future donors under similar conditions.

Commercial Review.

NEW YORK, Monday, December 8.

Evidence is beginning to multiply that in entertaining expectations of good trade next year, machine-tool manufacturers have excellent reasons for doing so. One of the biggest machine-tool men on the "street" is our authority for the statement that the Westinghouse Electric & Manufacturing Company will probably be a purchaser of machine tools next year to the extent of about $1,000,000. As we stated some time ago, the company is practically doubling its manufacturing capacity by the construction of an addition to its present plant at East Pittsburgh, Pa. This addition, which is over 1,200 feet long, is now in course of construction, and the probabilities are that sufficient progress will have been made in it ere long to justify specifications being drawn for the necessary equipment. It is this we have in mind when we mention the large contemplated machine-tool purchase in question. Efforts to obtain verification of the report in this vicinity were not very successful, because matters of this kind are solely attended to in Pittsburgh, but enough information was gleaned to create the impression that the report can be relied upon to a great degree.

Another large order which the new year has in store is for the purchase of the equipment of the new shops of Henry R. Worthington at Harrison, N. J. This will form an outlay of some $500,000. We are informed that the specifications are now beginning to assume definite form, but just when they will reach the "street" is a matter that is as yet in abeyance.

The International Steam Pump Company has not as yet given out the order for the $200,000 worth of equipment it intends to install at the works of the Snow Steam Pump Company, but will probably do so in the near future. Some small orders for foundry equipment were given out during the past week.

Shortly after the National Machine Tool Builders' Association was organized, we ventured the prediction that one of the beneficent results that would follow from it would be that it serve as an impetus to manufacturers of machinery in all lines to band together for the purpose of protecting and extending their trade, and particularly in promoting a friendly feeling among them. That the National Machine Tool Builders' Association, since its inception, has measured up admirably to expectations in this regard, we have on numerous occasions shown, taking comments heard in machinery circles as the basis of our statements.

During the past week a very notable contribution to the conditions we have mentioned was furnished by the manufacturers of machinery in Minneapolis, and particularly builders of sawmill machinery, who, perceiving the effects of the ruinous competition among them, and incidentally the bad feeling which it occasionally engenders, have decided to form an association for the purpose of eliminating the one and of preventing the other.

The proposed association is going to address itself to the fulfillment of projects, which are the most ambitious, from a machinery standpoint, that have come under our observation. Not only does it intend to take all manufacturers of machinery in Minneapolis in its embrace, but it also proposes to rent a building in which samples of machinery made by each of them will always be on exhibition, and an effort will be made to get the railroads

to offer reduced rates at certain times of the year, with the hope of attracting purchasers.

A local manufacturer discussing the project says: "Something of this kind should be done to stop some of the cutthroat competition that has been going on between the local machinery manufacturers, especially among those who make a specialty of sawmill outfits. Some of the tactics of these concerns have driven business away from the city entirely. They always make it a point to run down local competing firms and would rather see the contracts go to other cities than see some of their local competitors get the work. An association would work up a friendly feeling between the various local manufacturers, advertise the city as a great machinery center, and would probably be able to get lower freight rates for shipments, as associations of other kinds have done. The idea has been favorably received by the most of them, and will probably be followed. It will be to the interests of all concerned."

Some of the evils which this manufacturer has noted in Minneapolis obtain in a great many machinery emporiums throughout the country. They are evils which should occasion no surprise, for many, if not all, of them are those to which the machinery trade, and one might say all kinds of trade, is heir. Nevertheless much of the injury they do could be eliminated, partly if not entirely, by the formation of associations of the character this Minneapolis association intends to assume.

We are not perhaps greatly in error, to say the least, when we say that some of the evils enumerated were to be found in Cincinnati previous to the formation of the National Machine Tool Builders' Association, whose membership is largely recruited from the ranks of manufacturers in that city. When each of them formed an entity in himself, doubtless the existence and deleterious effects of at least some of those evils asserted themselves. But since these manufacturers became part and parcel of the National Machine Tool Builders' Association, the "one for all and all for one" spirit which such membership should imply, has resulted in uniform prices among them being maintained, a better feeling among them being created, and the general conditions surrounding their trade being greatly improved. We have no doubt that similar good will result from the work of this Minneapolis association, whose program is both model and laudable, and worthy of emulation where the evils it seeks to destroy are to be found.

The slight recession in the machinery trade recently has been responsible in more attention being given to foreign business than we have observed in several months. Several machinery houses have informed us of having taken some foreign orders recently, information they have not been able to give for some time past, though specific questions with that object in view have been frequently applied to them. Still our foreign trade, as it relates to machinery, has been surprisingly small, and notably during the past year.

There are several potent reasons which can be advanced for this condition of affairs. The war in South Africa, which practically paralyzed trade both in that country and in England while it was in progress; the industrial depression which has prevailed in Germany, and the intolerable tariff regulations which have been enacted into law in various countries on the Continent, have all operated as factors in the poor foreign machinery trade of the past year. Yet all of the causes mentioned sink into insignificance, compared to what is believed to have been the controlling cause of it all, viz., the failure of American manufacturers to utilize the opportunities for trade abroad which have practically been knocking at their door. This is the reason assigned by those who have been on the ground, and the noteworthy feature of it is that it is shared in by the manufacturers themselves. We say noteworthy, because rarely do we see ourselves as others see us.

The only answer which American manufacturers have heretofore given is, that they have had all that they could do to take care of their domestic orders without concerning themselves with booking any from abroad. The situation in the machinery trade during the past year—of the rush variety that it has been—makes this answer at once truthful and forcible. Recent developments in machinery circles therefore are interesting, if for no other reason but that they show, that when any recession in trade occurs here—as during the past month—we must again state that everyone believes it will end with the present month at the latest—machinery builders can become active in foreign fields with gratifying results.

That it is an ill wind that blows nobody good has passed into a proverb. Proof of the fact is furnished in recent statistics furnished by the Treasury Department. The adverse conditions of trade abroad during the past year, which we have previously enumerated, and the good times we have frequently made mention of during the same period here, have been a boon to foreign interests. Nothing shows this more forcibly than the table of imports of iron and steel for the ten months ending with October, 1902, compared with the corresponding months of 1901. This is as follows:

	1891.	1892.
Pig iron	$1,219,837	$7,272,913
Ingots, blooms, bars, etc.	1,101,257	6,242,609
Tin and terne plates, etc.	4,089,200	3,329,333
Machinery	2,471,946	3,427,159
Cutlery	1,443,213	1,421,852
Scrap iron and steel	275,380	1,262,784
Railway bars	42,063	1,226,824
Bar iron	920,156	1,032,834
Firearms	918,117	898,511
Wire rods	820,098	805,765
Wire and mfrs. of	471,843	494,543
Sheet and taggers iron	340,238	433,648
Needles	$341,713	$355,627
Shotgun barrels	250,862	230,375
Hoop, band or scroll	110,031	118,221
Files, etc	44,858	66,207
Chains	24,854	46,648
Anvils	31,065	25,073

These figures show that the importations of iron and steel manufactures in the ten months ending with October, 1902, are double those of last year. They are also three times as much as those of 1898, and are larger than in any year since 1891. The total value of iron and steel manufactures imported in the ten months ending with October, 1902, is $31,987,056, against $16,349,427 in the same months of last year and $10,531,090 in the corresponding months of 1898. In practically every class of articles the figures of the year just ended are larger, both in quantity and value, than those of last year, and in many cases the figures are more than double those of last year. Pig iron, for example, has increased from 39,336 tons in ten months of 1901 to 406,610 tons in ten months of 1902; bar iron has increased from 38,233,515 pounds in ten months of 1901 to 51,586,822 pounds in ten months of 1902; ingots, blooms, billets, etc., have increased from 14,791,617 pounds in ten months of last year to 497,304,854 pounds in ten months of the present year.

The Chicago Pneumatic Tool Company report the business outlook to be first class, their connections in all countries keeping them in close touch with the business situation, so that they can judge of the general conditions everywhere. Some recent changes have been made by them in their representatives in this country. Mr. Geo. A. Barden, who has been representing the company at Buffalo, has been transferred to the Philadelphia field and Mr. C. R. Green, who has been connected with the Cleveland office of the company, has succeeded Mr. Barden in Buffalo. Mr. Chas. Parsons, who recently became connected with the company, is now traveling in the Northwest.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, who has been spending some time in Europe, is returning to America with a large number of orders induced by their increasing trade there.

The Crocker-Wheeler Company, Ampere, N. J., manufacturers of electrical machinery, have included among their shipments of engine-type generators for the month of November the following: One 400-kilowatt for the Stephen Girard Building, Philadelphia, Pa.; one 100-kilowatt and one 125-kilowatt for the Missouri Pacific Railway, St. Louis, Mo.; two 150-kilowatt for the Penna. Malleable Company, McKees Rocks, Pa.; one 200-kilowatt for J. L. Mitchell, Philadelphia, Pa.; two 50-kilowatt for the Liveright & Greenwald Building, Philadelphia, Pa.; two 100-kilowatt for the McClintic-Marshall Construction Company, Pottstown, Pa.; one 300-kilowatt for the Grand Crossing Tack Company, Chicago, Ill.; one 400-kilowatt

for the Lake Construction Company, Erie Co., Pa.; one 250-kilowatt for the Wilmington City Electric Company, Wilmington, Del.; one 225-kilowatt for the Pine Bluff & Western Railway, Pine Bluff, Ark.; two 150-kilowatt, one 200-kilowatt and one 75-kilowatt, for the Woodward & Lothrop Building, Washington, D. C. The company report that their new mill building is now being occupied, enlarging their floor space by 60,000 square feet, giving increased facilities for prompt deliveries on large orders.

The Northern California Power Company has recently installed a 4,000 horse-power generating plant at its Cow Creek station, and is typical of the many transmission plants which have recently been installed in California. The ultimate capacity of the station will be 8,000 horse-power when the demand for power reaches this amount. The company has already installed 3,000 horse-power at another generating station, known as the Battle Creek Station, thus making the present total capacity of the company's electrical installation 7,000 horse-power. The apparatus installed in the Cow Creek Station consists of two 1,500-kilowatt three-phase Westinghouse alternators, which will be driven by impact water wheels supplied with water under a head of approximately 900 feet. The company has also purchased from the Westinghouse Electric & Manufacturing Company the exciters, switchboard and raising transformers for this station. The transmission will be at 34,000 volts. The Battle Creek station is likewise equipped with Westinghouse apparatus.

The new foundry of the American Shipbuilding Company, at Detroit, will be equipped with 72-inch and 42-inch Newton patent cupolas made by the Northern Engineering Works, Detroit. The new buildings are nearly under roof and when completed the plant will be a model one for heavy work.

The Cambridge Electric Light Company, of Cambridge, Mass., has recently purchased from the Westinghouse Electric & Manufacturing Company ninety-nine induction motors, which will take care of the bulk of the power service, comprising every possible use of electric power in a city of this kind, from public works to small tailoring establishments. The order comprises eleven motors of 1 horse-power, twenty-six motors of 2 horse-power, nine motors of 3 horse-power, nineteen motors of 5 horse-power, twenty-five motors of 7½ horse-power, and nine motors of 15 horse-power.

CHICAGO MACHINERY MARKET.

The first week of December established a record in the volume of business in machinists' supplies, which if continued throughout the month would make it the banner month of the year. But that the pace thus inaugurated will continue throughout the holiday season and throughout the ante-inventory period is not anticipated. The Hodge & Homer Company say they usually begin inventory about the middle of December, completing the work before the expiration of the year, but that if business continues as it was the first week of December it will be impossible for them to undertake stock taking in December. There are many similar reports. November was not a particularly active month in machinists' supplies, falling off some from the October total.

By way of illustration of the general activity, a large seller of supplies for metal shops remarked that they had been having great difficulty in procuring buffs. One factory, from which they had been buying, were 30,000 sections behind in filling orders and were not gaining. Another factory could make fairly prompt shipments on some, but not all sizes and grades. Buffs of the greater scarcity were those used by brass workers, the foundries in that metal being busy perhaps above the average of industries. Telephone manufacturers, makers of electrical supplies and similar lines of industry are calling actively for supplies of all kinds. In fact, the growth of trade comes mainly from the shops that make some specialty of popular and permanent demand. Shops of that description are growing rapidly and consuming large quantities of material and supplies.

Canal street, which has been for many years the center of the machinery and supply trade in Chicago, is proving too contracted, and just now there is in progress quite an overflow movement to the adjoining street, Clinton, to which several prominent houses will remove next spring.

William Ganschow is now running his shop up to 9.30 in the evening, to get out the work that has been promised for this month. He has been running full all year and only recently was obliged to run overtime. The gear-making trade is good and the gear-cutting trade better.

The general rule is for machine shops to be running full with a few overtime. Individuals who want work done in machine shops still say they have great difficulty in inducing shops to undertake it; often greater difficulty in getting it back on time. The scarcity of labor is one of the troubles. Even the multitudinous boy has vanished. A Canal street house last week applied to an employment agency for an office boy, but without success, the manager telling him they had 96 applications for boys and only 24 boys "in stock."

Quotations.

NEW YORK, Monday, December 8.

New York prices for Northern and Southern irons for the first half of 1903 are as follows:

Northern:

No. 1 X	$23 25 @ $24 75
No. 2 X	22 00 @ 22 75
No. 2 plain	21 00 @ 21 75

Southern:

No. 1 Foundry	23 25 @ 23 50
No. 2 Foundry	22 25 @ 22 50
No. 3 Foundry	21 50 @ 22 00
No. 4 Foundry	20 50 @ 21 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.20c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11⅝ @ 11¾c.; electrolytic and casting, 11½ @ 11⅝c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 25 @ 25⅛c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—5.10 @ 5.15c.

Antimony—Cookson's, 8½ @ 8⅞c.; Hallett's and U. S., 7¼ @ 7½c.

Lard Oil—Prime City, 88 @ 90c., according to brand and quantity, ranging from one barrel up to large lots.

Manufacturers.

J. D. Boardman has started a pattern job shop in Seneca Falls, N. Y.

The Pittsburgh (Pa.) Printing Company is preparing to fit up a larger plant.

The Hart Grain Weigher Company, Peoria, Ill., will shortly erect a foundry building.

The Hagerstown (Md.) Metallic Bed Company is building a factory, 163 feet long.

The main building of the Baltimore (Md.) Terra Cotta Works has been badly damaged by fire.

Fire at Boston, Mass., has destroyed valuable machinery of Graves & Phelps, furniture makers.

The York Lumber Company, Grafton, W. Va., is greatly improving a plant which it has purchased.

The Fiberloid Company, Newburyport, Mass., has bought a site for new buildings at Springfield.

A large addition is to be erected for a branch of the American Can Company in Baltimore, Md.

The Windsor Knitting Mills, Hagerstown, Md., will, it is said, locate a branch factory in Greencastle.

It is rumored that a new knitting machinery manufactory is soon to be started at Laconia, N. H.

The Grand Trunk system is to enlarge the shops at Stratford, Ont., to a capacity of about 300 new men.

The Hamilton-Brown Shoe Company, St. Louis, Mo., has received a permit for a $60,000 factory addition.

The Williamson Patent Vise Company, recently organized in Bradford, Pa., has secured a building site.

A new concern, the Peary Side Bearing Company, capital stock $300,000, is about to build a plant at Joliet, Ill.

The American Dredging Company, Philadelphia, Pa., has purchased a large tract in Camden, N. J., for a plant.

The Pittsburgh Railways Company has

taken out a Pittsburgh building permit for a $10,000 machine shop extension.

It is reported that Cnas. McCormick will build a factory at Emeryville, Oakland, Cal., to manufacture a patent machine.

The Coplay (Pa.) Cement Manufacturing Company has been making arrangements looking to the enlargement of its plant.

Plans are being prepared for a $40,000 factory for the Thos. Kent Manufacturing Company, woolens, Clifton Heights, Pa.

A warehouse of the Union Pacific Railroad at Omaha, Neb., containing air-testing machinery, supplies, etc., has been burned.

Charles E. Sipple, of Gowanda, N. Y., has been at Cherry Creek in connection with the proposed erection of an electric lighting plant.

Fire at Hartsville, Mass., has destroyed a foundry, machine shop, planing mill, sawmill and box shop of George A. Stevens. He will rebuild.

The Reade Machinery Company, Cleveland, O., has leased five acres in Collinwood, and will build a shop there for repair of large machinery, etc.

The McKeesport Brick Company, having plants at McKeesport and Muir Station, Pa., will remove the latter to a new site at Duquesne, enlarging it.

A pump manufacturing concern is considering the establishment of a plant in Chattanooga, Birmingham, New Decatur, or some other Southern town.

The James Gibbs Manufacturing Company, manufacturer of belt dressing, etc., Elizabeth, N. J., may build a new plant at Williamstown or elsewhere in Massachusetts.

The James Anthony Company, of Memphis, Tenn., is stated to have announced that a plant for the manufacture of suction rods for oil wells has been secured for that city.

The Wilkes Foundry Company, Toledo, O., will enlarge its main building and build another, 160x500 feet, which will be equipped with molding machinery and fitted with electricity.

A "rotary engine" at the plant of the Union Waxed & Parchment Paper Company, Franklin, O., recently went through three brick walls, burying a man in the debris and wrecking a machine room.

The American Tube Works, manufacturer of brass and copper tubing, now located at Somerville, Mass., has purchased 50 acres in Braintree, and will build a plant there to accommodate 1,200 to 1,600 men.

Contracts have been awarded for a four-story, 81x101-foot addition to the plant of the Jenks & Muir Manufacturing Company, Detroit, Mich., manufacturer of mattresses, iron and brass bedsteads and springs, etc.

The Improved Socket & Chuck Company, Braddock, Pa., has been formed to manufacture a new system of drill sockets and chucks. It is represented by Frank H. Czarniecki Company, 335 Fifth avenue, Pittsburgh.

The Wright Taper Roller Bearing Company, Buffalo, N. Y., informs us that the factory for which it has plans on file will be a three-story stone building, 217x44 feet, with two L's, one 40x60 and the other 40x56 feet. The building is already above the first story.

It is reported from Marion, Ind., that a number of tin plate workers have formed a company, with a capital stock of $300,000, and will establish a mill in Los Angeles, Cal. Several hundred workmen will go there. N. J. Coppick is secretary of the new company.

The American Screw Company, of Providence, R. I., has absorbed the Massachusetts Screw Company, of Holyoke, Mass., by purchase of its tools, equipment and contracts. The plant, which has a capacity of 200,000 gross daily, will be moved to Providence.

Plans are progressing for the location in Waterloo, Ia., of an 80x140-foot foundry with an employing capacity of 80 men. The name ascribed to it is the Waterloo Foundry Company. The local Chamber of Commerce appears to be in touch with the enterprise.

It is reported from Asheville, N. C., that a pulp paper mill, with strong financial backing, is proposed to be established in Western North Carolina. The promoters, represented by T. W. Neeland, of New York, are negotiating for tracts comprising 72,000 acres of land.

It is stated in Roseburg, Ore., that F. J. Blakely, representative of the Oregon Boom & Timber Company, has returned from the east with plans for extensive sawmills which the company is to build in that vicinity. They will be run by water and have auxiliary steam power.

The Wm. Powell Company, Cincinnati, O., is in the market for all styles of automatic machinery for the manufacture of steam brass goods. They would like particularly to hear from concerns making a small, very light circular swing saw, for cutting telescope tubing.

The Mason Lubricator Company, Madison, Wis., and O. G. Kipp (lubricator) Manufacturing Company, Rochelle, Ill., have consolidated and will build a new factory. The new company expects to extend its lines of manufacture. It may also build a plant in Canada.

The Toledo, O., Chamber of Commerce has been negotiating to secure a plant for the manufacture of the Fisher steam rotary pumps and other patented devices for use in connection with power plants. The new company is being capitalized at $60,000. Mr. Fisher is a Denver man.

The Foster Manufacturing Company is being organized at Davenport, Ia. (or Bettendorf), to manufacture implements, and is about to break ground at Bettendorf. The first building will be a 180x400-foot storehouse. George C. Foster is prominently interested in the company.

Articles of incorporation have been issued to the Panhorst Company, Marietta, O., capital stock $10,000, authorized to deal in oil, gas, coal and timber properties and real estate. Frank Panhorst is president and general manager. Offices have been opened in the Register Building, Marietta.

The Eagle Shoe Company, incorporated at Newport News, Va., intends shortly to erect a factory building in that city. The company has a capital stock of $100,000. The officers include V. M. Fleming, president; Elias Peyser, vice-president; A. D. Tapscott, secretary; George A. Schmelz, treasurer.

G. Jaeger, of Monongahela, Pa., has secured a patent for a machine for manufacturing woven wire fencing. It is stated that a company will be formed for the manufacture of both machines and fencing. Adolph Boes and G. Langer will be the president and secretary of the new corporation.

An addition has just been erected at the factory of the Friend Manufacturing Company, manufacturer of the "Friend" spray pumps, Gasport, N. Y. The company is successor to Hull Bros. We have mentioned the matter before, but wish to correct a slight error in reporting the name of the concern.

It is reported from Toledo, O., that the recently organized Globe Window Glass Company has authorized its directory to purchase a site on which to erect a factory toward spring. Meantime the company proposes to operate the Globe glass plant at Findlay, the purchase of which was also authorized.

The Southern Brick & Tile Manufacturing Company, Ltd., has been organized, has secured a bed of clay in southwest Louisiana, and by January 1 will have a plant ready to utilize a machine invented by T. S. Bradley, of New Orleans, which is believed to be a radical improvement in brick making.

The Washington Chemical Manufacturing & Supply Company has purchased a site at Washington, Pa., and will build at once. The company is capitalized at $50,000, and its officers are as follows: President, T. A. Griffiths; vice-president, D. B. Forrest; secretary, Eli Gray; treasurer, H. J. John; all of Washington.

The Wright Carriage Body Company has been organized at Moline, Ill. The following officers were elected: President, T. M. Sechler; vice-president, C. W. Wright; secretary and treasurer, E. H. Wilson. The main building will be 150x60 feet. The machine shop and dry room will be together and in a building 60x60 feet.

The Armstrong Cork Company, of Pittsburg, Pa., has closed the deal for a manufacturing site at North Rochester, Pa., and has let the contract for the erection of the plant, which will be devoted, it is said, to the manufacture of an insulating material against heat. The main building, among several, will be 100x170 feet, four stories.

Jerome Hill, of Memphis, Tenn., has issued a prospectus of the proposed International Warehouse Company to be established in New Orleans in order to concentrate the chief cotton-carrying trade of the world there instead of at Liverpool. It is planned to erect two large warehouses with electric or pneumatic cotton-handling appliances.

The W. J. Clark Company, plate and sheet metal worker, at Salem, Ohio, is installing in its works a hydraulic plate-bender calculated to work at 146 tons pressure. This is the third hydraulic bender and former which the company has found it necessary to have to enable it to keep up with the growing demand for heavy work in its line.

A new boiler works will be established on Water street, Toledo, O. It is backed by Douglass G. Flanner, president of the Rib River Lumber Company, of Toledo, with a couple of Bay City, Mich., men. It will make a specialty of marine work, giving employment to from 80 to 100 men, and will contain, among other equipment, a large punching press.

It is announced from Guthrie, Okla., that a company, with a capital stock of $400,000, has been organized to exploit the asphalt beds of Comanche County, and will erect a plant to cost $40,000. The stockholders are: Dr. Brownup, of Utica, N. Y.; O. G. Young, of Kansas City, Mo.; Congressman Dennis Flynn and Charles E. Billingsley, of Guthrie, and others.

A charter has been granted to the Virginia Machinery Company, which is to operate a plant in the Basic City Car Works buildings, at Basic City, Va., and to manufacture engines and other machinery. The officers are J. A. Patterson, of Waynesboro, president; M. J. Fulton, of Front Royal, vice-president; T. A. Sammis, of Basic City, secretary and treasurer.

A wall paper mill will be located at Stevens Point, Wis., where it will occupy buildings now standing. It will be known as the Western Wall Paper Mills. F. M. Baker, of Chicago, formerly with the Art Wall Paper Mills, is to be the manager. Christian Heidorf, of Chicago, will be superintendent. The raw material will be secured from Stevens Point paper mills.

It is rumored that Mayor Jones, of Toledo, proposes to establish on the outskirts of that city a large co-operative factory for his Acme Sucker Rod Company. It will, to some extent, follow the idea of his friend, N. O. Nelson, of St. Louis. A foundry may be included in the establishment and there will be houses for em-

ployees, a public hall, dining-room, gymnasium, etc., also children's amusement grounds.

The Royal Blend Beverage Company, Ltd., is a limited partnership association which has filed articles, with a paid-in capital of $300,000, and will establish a plant at Grand Rapids, Mich., to make coffee substitutes, food products, etc. Henry M. Lawson, manufacturer of a patent substitute for coffee, is the chief stockholder in the enterprise and will move his outfit from Benton Harbor, Mich.

A company is being formed at Buffalo, N. Y., to manufacture a gasoline turbine on which a patent has been applied for by Dr. John W. Kales, of Franklinville, N. Y. Col. F. Montgomery, of 71 Norwood avenue, Buffalo, is financial agent of the company, which has opened office in the Ellicott Square. It is proposed to capitalize the concern at $5,000,000 and to erect a plant employing upwards of 1,000 men.

It is stated in Denver that E. F. Dyer & Company, Cleveland, O., builders of beet sugar machinery, have contracted to erect beet sugar factories at Fort Morgan and Brush, Colo. A representative of the National Construction Company, Detroit, Mich., has signed a contract, we understand, to build one at Alamosa, Colo. Another factory is to be built at Castlewood dam, Colo., W. C. Johnston, an investment man, being the promotor.

The Lapointe Machine Tool Company, incorporated with a capital stock of $50,000 for the purpose of manufacturing some of J. N. Lapointe's patented tools, has just started business at No. 35 Hartford street, Boston, Mass. J. N. Lapointe is president and manager; H. Pothecary, secretary-treasurer. The company's specialties include a keyseat cutter and splining machine, a machine for polishing pinion leaves and some other tools. A patent is now pending on an adjustable reamer.

C. B. Pride, Appleton, Wis., has received contracts to plan and construct a mill at Independence, Kan., to manufacture book and wrapping paper from sugar cane rind. By a recent invention the pith may be extracted, leaving the fiber available for this use. The employment of sugar cane for such a purpose is predicted to have a wide vogue, since the northern forests are fast being devastated. It is also reported that the Colin Gardner Paper Company, of Middletown, O., has placed contracts with C. B. Pride for the erection of a paper and a sulphite mill at Middletown, with the idea of experimenting in making paper from corn stalks and wild grasses.

Waterloo, Ia., expects to secure a number of new factories. The Waterloo Motor Works will build Duryea automobiles as well as the goods now made by the Waterloo Gasoline Engine Company and the Davis Gasoline Engine Company, which will be consolidated with it. The company will erect a main building, 80x300 feet, two stories, besides a foundry and other structures, and will employ 200 men at the start. We do not know that this involves the removal of the Duryea Power Company from Reading, Pa. The Hawes Threshing Machine Company, Decorah, Ia., will remove to Waterloo, erecting there a two-story, 80x300-foot building. The Russell Self-Feeder concern, of Sheldon, Ia., has also been secured, and will erect a 40x180-foot, two-story building. It is thought that the Swift Manufacturing Company, of Waterloo, grinders, is contemplating the erection of a new factory.

The following item is from Minneapolis, Minn.: "Representatives of the Harris-Gates syndicate and the Pittsburg Pressed Steel Company held a conference with Dr. H. Oscar Ross at the English and discussed the plan of erecting a $200,000 branch factory in Minneapolis. Representatives of the Westinghouse Company, of Pittsburg, were also present at the conference. It was decided virtually to erect in or near this city a plant for the manufacture of the Ross cement and steel railway cross ties. The inventor of this new addition to the business of railroading is the president of the International Mosaic Cement Tile & Stone Syndicate. The new company will be capitalized at $1,000,000, and will have ten branches. The company has ties to the value of $200,000 already sold. It was learned that a branch factory will be established at Terre Haute." Whether the International Syndicate referred to is the same as the new company, we are not sure.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Grant. Gears. See upper corner, page 54.

See the Lowe test indicator, page 12.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Stamping Dies. Emmons Collins, Chicago.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Cnase, Newark, N. J.

For Sale—One 2 H.-P. gasoline engine; price $50. P. O. Box 1171, Springfield, Mass.

Working drawings for special machinery, patent articles, etc. Geo. M. Mayer, M. E., Monadnock, Chicago.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Practical manufacturing expert, designer of special tools, shop systems, etc. Eugene Wilson, AMERICAN MACHINIST.

Iron planer wanted, 54 to 60 inches square, 14 ft. bed; spot cash for good tool. Electric Machinery Co., Minneapolis, Minn.

An experienced engineer will perfect, simplify or improve upon articles of manufacture. Address Box 236, AMERICAN MACHINIST.

Wire pointing machinery, from ½ in. downwards; address of maker wanted. Godrich, Wharf street, Aston, Birmingham, Eng.

Light and medium machinery built to order; estimates furnished on all kinds of machine work. F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa.

Garvin turret No. 00, new, bottom slide left blank, can be fitted to any small lathe; six tool-holders, also blank; $60 cash. H. Bailey, 453 Washington st., Buffalo, N. Y.

Wanted—Building, about 7,000 square feet floor space, suitable for machine shop; easy access to New York; to rent or purchase. Address Box 292, AMERICAN MACHINIST.

Wanted—A thin casting foundry or manufactory which will undertake manufacturing of a new patented drinking water purifying and refrigerating apparatus for housekeeping. Box 298, AMERICAN MACHINIST.

Wanted—Light machine work and special machinery to build to order, special tools, die and punches; a well-equipped water-power plant and first-class workmen. The Bantam Mfg. Co., Bantam, Conn.

Wanted—Additional capital for the purpose of increasing the output of an established automoblie manufactory having a number of perfected vehicles now running on the road. Box 314, AMERICAN MACHINIST.

For Sale—An established automobile business, having bona-fide venicles running on the road; includes well-equipped plant in large city, drawings, patterns, patents and good will. Box 313, AMERICAN MACHINIST.

Wanted—A large contract to build medium or light automatic machinery; we have the plant, the experience, the capital; cam cutting a specialty; we make the best adjustable reamers. Ott. Mergenthaler Company, Baltimore, Md.

Liberal commission to machinery salesmen able to handle, as a side line, machines suitable for use by railroads, machine shops, saw and planing mills and by all manufacturers of wood and metal. Address Box 241, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

A chance to introduce specialties and establish agencies among the mill supply and hardware trade throughout the country; we have one of our own, are incorporated, and our salesmen are constantly visiting the trade; bank and business references. Address The Chase Company, Lancaster, Pa.

Co-operation of a machine shop-firm to manufacture a kerosene oil internal combustion engine of undoubted merits and now in operation; the market is wide open; you do the building and we the selling; very small capital required. You deal with well-known business men when you address G. K., Box 283, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Machine designer, etc., wants position. Address Box 63, AMERICAN MACHINIST.

Draftsman, designing, able, open for engagement. Box 303, AMERICAN MACHINIST.

As foreman, by A1, progressive pattern maker. K. G., care AMERICAN MACHINIST.

Draftsman with shop experience wishes position. Box 300, AMERICAN MACHINIST.

Foreman and superintendent, 20 years' experience, open for engagement; die work preferred; best references. Box 271, AM. M.

Young graduated Swede, as mechanical draftsman; 3 years' experience, partly in America. Box 316, AMERICAN MACHINIST.

Mechanical-electrical draftsman, Norwegian, 24, graduate, Germany, desires to change position. Box 294, AMERICAN MACHINIST.

Mechanical draftsman, graduate, 3½ years' experience in shop and drawing room, best references, desires position. Box 289, AM. M.

Situation as foreman, transmission and special machinery, jobbing; 12 years in charge; best references. Box 296, AMER. MACHINIST.

Mechanical engineer, graduate Stevens Institute, 6 years' practical experience, desires change of position. Address Box 309, AM. M.

Draftsman (technical education), experienced on machine tools and special machinery, would like permanent position about January 1. Box 295, AMERICAN MACHINIST.

Superintendent or general foreman of machine shop, by practical mechanic; 24 years' experience; 12 years in charge; 38 years of age. Box 310, AMERICAN MACHINIST.

Position as assistant superintendent or foreman, by a young engineer who has had experience in similar positions; best of reference. Box 268, AMERICAN MACHINIST.

General foreman, responsible man, age 34, experienced in high-class automatic and interchangeable machinery, wishes to make change about January 1. Box 312, AMER. MACH.

Situation wanted by an up-to-date machine shop foreman with varied experience; can handle help profitably and is a thorough mechanic. Box 305, AMERICAN MACHINIST.

Wanted—Engagement, by a young man studying correspondence course, as apprentice, to acquire experience in mechanical drawing and engineering. H. L. E., care AM. MACH.

Wanted—Position as manager or superintendent; am well up in boiler, steam engine and foundry practice, cheap production and accurate cost system. Address Box 293, A. M.

A man with 15 years' experience in shop, on the road and in drawing room on engine work, desires to make a change; at present in charge of shop. Address Box 297, AM. MACH.

Mechanical engineer, expert designer, wishes position with large manufacturing concern, to design special machinery and introduce labor-saving methods. Box 307, AMER. MACHINIST.

Machine designer wants responsible position; technical graduate; shop experience; experienced in engines, printing press, screw and tobacco machinery, automobiles, etc. Box 308, AMERICAN MACHINIST.

Superintendent or manager of factory or

machine shop; energetic young man, age 32, with a wide experience of 17 years; thorough mechanic, first-class executive, competent to handle plant of any size and get results; now employed. Box 301, AMER. MACHINIST.

Position wanted as correspondent or representative by technical graduate with 5 years' varied experience in shops and drawing offices, here and abroad; 2 years' experience in civil engineering; excellent knowledge of German, some French. Box 304, AMER. MACHINIST.

Position as manager (or assistant manager large concern); thorough experience in handling office and manufacturing departments; expert in accounting, methods of increasing production and obtaining accurate detail costs; experienced correspondent with legal training; age 32. Box 317, AM. MACH.

Wanted—Position, by a first-class tool maker, as foreman or assistant superintendent; 15 years' experience in the manufacture of light interchangeable parts for high-class special machinery and a good handler of men; at present holding position paying me $1,800 per year, but wish to change on account of bad locality; will be able to change about January 15. Box 299, AMERICAN MACHINIST.

An A1 shop superintendent, who is now employed, would make desirable change; thoroughly understands management of men; 20 years' experience; up to date on jigs and fixtures for rapid production; medium or heavy work preferred; good recommendations; wish to locate in vicinity of New York city or in the New England States. Address Box 306, AMERICAN MACHINIST.

Help Wanted.

Wanted—Good tool and die maker on bicycle work. Address Day Mfg. Co., Lakeview, N. Y.

Wanted—First-class machinists, in city near Philadelphia; steady work and good pay. The Reeves Engine Co., Trenton, N. J.

Wanted—Machinists and draftsmen to send postal for free set tables of lathe gearing and valuable formulas and tests. Box 290, A. M.

Wanted—One first-class toolmaker; one accustomed to watch tool making preferred. National Optical Co., 11th and Mifflin sts., Philadelphia, Pa.

Liberal commission to machinery salesmen to handle, as a side line, the Hartford Bench filing machine. Kinsey-Burt Co., 136 Liberty st., New York.

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Wanted—Electrical engineer to run gas engine and electric light plant. Apply, stating experience and salary expected, to C. J. Goodnough, secy., Emporium, Pa.

Wanted—Foreman for machine shop employing 30 to 40 hands; job work principally; technical education preferred. Address A. W. K., care AMERICAN MACHINIST.

Wanted—Positions for experienced men, and men for such positions. Address James Brady (late Brady Mfg. Co.), Room J, 20th Floor, 220 Broadway, New York.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—A man who is accustomed to hardening and tempering all kinds of tools; steady work; give references and experience; confidential. Box 272, AMERICAN MACHINIST.

Wanted—Sheet-metal workers, carriage trimmers, body-makers, blacksmiths and machinists. Apply Fournier-Searchmont Automobile Co., Trainer, Delaware County, Pa.

Draftsman; good opening, New York city; high-class machinery; reply to be noticed must establish character and ability; state age, experience and salary. Box 311, AM. MACH.

Help Wanted.—Western man as machine shop foreman in manufactory of agricultural machinery; give reference, experience and salary expected. Box 315, AMER. MACHINIST.

Wanted—Ten first-class machinists on small, close work; good wages and steady work to competent and reliable men; no trouble. Apply to The Harris Automatic Press Co., Niles, Ohio.

Swedish-Americans wanted; several first-class locomotive erectors and locomotive boilermakers; apply, stating age, experience and wages expected. Address Vagn-och Maskinfabriks-Aktiebolaget, Falun, Sweden.

Wanted—At once, a first-class draftsman; one accustomed to a general run of machine work and capable of doing his own thinking and designing; a good position to the right man. Address Box 247, AMER. MACHINIST.

Wanted—Experienced designer and draftsman who thoroughly understands compound engines; permanent employment for competent man; state age, experience and salary wanted. "Manufacturer," Drawer 974, Buffalo, N. Y.

Wanted—As foreman, a good, all-round machinist who has had experience in managing men and is energetic and ambitious to secure a life position at good wages; state age, experience and reference. Address Josiah Ross, Buffalo, N. Y.

We are constantly increasing the scope of our work, and invite application for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—For Detroit suburb, first-class machinists and diemakers on press and die work, also good, all-around blacksmith on die and tool forgings; permanent positions to reliable men. Address Michigan Manufacturing Co., Ypsilanti, Michigan.

Wanted—Foreman; responsible and experienced man to produce right interchangeable work; shop is equipped with new and highest grade tools; just starting to manufacture; good chance for right man. Address Box 291, AMERICAN MACHINIST.

Master mechanic wanted to take entire charge of mechanical department of large rubber factory near New York; must have large experience and be perfectly qualified for the position. Address, with full particulars, "Machinery," Box 578, 120 Broadway, N. Y.

Wanted—An experienced mechanic; one able to operate automatic machinery, design and build labor-saving machinery and to take charge of repair work in a nut and bolt plant; prefer young man with experience in this line; state age, experience and wages wanted by the month. Address Box 273, AM. M.

James Brady, member American Society Mechanical Engineers, former owner of Brady Mfg. Co., consulting engineer and appraiser, particular attention given to economy in manufacture, can furnish good men for heads of departments in the metal-working industry. Room J, 20th floor, 220 Broadway, New York.

Wanted—An expert diemaker and general press man; one accustomed to cup work, such as bicycle and automobile ball bearings and fittings, and fully experienced in hardening, grinding and polishing low carbon sheet steel; give experience and reference; all communications strictly confidential. Address Box 302, AMERICAN MACHINIST.

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Bartlett, E. E., Boston, Mass.

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Cleveland Wire Spring Co., Cleveland, O.
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Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

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Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

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Schieren & Co., Chas. A., New York.
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Reed Co., F. E., Worcester, Mass.

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Boston Gear Works, Boston, Mass.
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Morse Chain Co., Trumansburg, N. Y.
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Bement, Miles & Co., New York.
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Armstrong Bros. Tool Co., Chicago, Ill.
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Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Dies, Sheet Metal
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Baush Mch. Tool Co., Springfield Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester Mass.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, O.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa
Nazel Mach. Works, Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mueller Mach. Tool Co., Cincin., O.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reade Mchry. Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.
Washburn Shops, Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas. Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dust Collectors
Allington & Curtis Mfg. Co., Saginaw, Mich.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Co., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Columbus Mach. Co., Columbus, O.
Cooper Mach. Co., Saltsburg, Pa.
Elyria Engine Co., Elyria, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
National Engine Co., Rockford, Ill.
New England Gas Engine Co., Boston, Mass.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Works, Freeport, Ill.
Struthers-Wells Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Furnaces
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dwight Slate Mach. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. Y.
Lubriphite Co., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Falkenau-Sinclair Co., Phila., Pa.
Frasse Co., New York.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co. Chicago, Ill.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Ohio.
Tanite Co., Stroudsburg, Pa.
Washburn Shops, Worcester Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.

Grindstones
Cleveland Stone Co., Cleveland, O.
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Works, Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Works, Buffalo, N. Y.
Frasse Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Iroquois Machine Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.
Toledo Mach. & Tool Co., Toledo, Ohio.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co. Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Power
Scranton & Co., The, New Haven, Conn.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.
Nazel Mach. Works, Phila., Pa.

Keys, Machine
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathes
American Tool Wks. Co., Cin., O.
Auto. Mach. Co., Bridgeport, Ct.
Automatic Mach. Co., Greenfield, Mass.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Prov., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Frasse Co., New York.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry Co., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Tanite Co., Stroudsburg, Pa.
Mich.
Washburn Shops, Worcester, Mass.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Wood
American Machinery Co., Grand Rapids, Mich.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.
Narragansett Mach. Co., Providence, R. I.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.
Lubriphite Co., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lubriphite Co., Jersey City, N. J.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Atlas Foundry & Mch. Co., Belleville, N. J.
Blanchard Mach. Co., The, Boston, Mass.
Fawcus Mch. Co., Pittsburgh, Pa.
Nazel Mach. Works, Phila., Pa.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Lowe, H. A., Waltham, Mass.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., E. Boston, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Vertical
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mch. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Tools, Adjustable
Geometric Drill Co., New Haven, Conn.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
American Foundry & Mach. Co., Hanover, Pa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Christensen Engr. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N.J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Nail Machinery, Wire
National Machy. Co., Tiffin, O.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Oil Cups and Covers
Bay State Stamping Works, Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mch. Co., New Britain, Conn.

Pans, Shop
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Prentiss Tool & Supply Co., New York.
Washburn Shops, Worcester, Mass.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.
Hartford Pattern & Model Co., Hartford, Conn.

Pencils
Keuffel & Esser Co., New York.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
American Tool Wks. Co., Cin., O.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Bench
Bartlett, E. E., Boston, Mass.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Presses, Hand
Perkins Mach. Co., So. Boston, Mass.

Presses, Hydraulic
Eimes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.
Prentiss Tool & Supply Co., New York.
Toledo Mach. & Tool Co., Toledo, Ohio.
Wold & Co., Torris, Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Howard Iron Wks., Buffalo, N. Y.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pulleys, Speed Changing
Speed Changing Pulley Co., Indianapolis, Ind.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.

Rods and Straps, Connecting
Standard Connecting Rod Co., Beaver Falls, Pa.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rules, Steel
Sawyer Tool Co., Fitchburg, Mass.
Starrett Co., L. S., Athol, Mass.

Safety Valves, Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Cochrane-Bly Mach. Works, Rochester, N. Y.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Sawing Machines, Wood
American Machinery Co., Grand Rapids, Mich.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.
Railway Educational Association, Brooklyn, N. Y.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Affleck, Geo. E., New York.
Baird Machy. Co., Pittsburg, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegheny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

Second Hand Machinery—*Cont'd*
Toomey, Frank, Philadelphia, Pa.
Wickes Bros., New York.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Oil
American Tool & Mach. Co., Boston, Mass.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mch. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Marshall & Huschart Mchry. Co., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Perkins Mach. Co., Boston, Mass.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
National Mchry. Co., Tiffin, O.
Perkins Mach. Co., Boston, Mass.
Reade Mchry Co., Cleveland, O.
Toledo Mach. & Tool Co., Toledo, Ohio.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Perkins Mach. Co., So. Boston, Mass.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett, E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Wilmington, Del.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Spike Machines
National Machy. Co., Tiffin, O.

Sprocket Chains
See Driving Chains.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Stamps, Steel
The Chandler Co., Springfield, Mass.
Schwerdtle Stamp Co., Bridgeport, Conn.

Steel, Machinery
Boker & Co., Hermann, New York.
Patriache & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Boker & Co., Hermann, New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., New Haven, Conn.
National Mchry. Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps, Collapsing
Geometric Drill Co., New Haven, Conn.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Geometric Drill Co., New Haven, Conn.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Mchry. Co., Tiffin, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Winter Bros. Co., Wrentham, Mass.

Telephone System
Clark Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Washburn Shops, Worcester, Mass.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
American Tool & Mach Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Prentiss Vise Co., New York.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Prentiss Vise Co., New York.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Washer Machines
National Machy. Co., Tiffin, O.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Drawing Machinery
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.

Wood Working Machinery
American Machinery Co., Grand Rapids, Mich.

Worm Hobbing Machines
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Automatic Mach. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.

An Engine Shop Erecting Floor.

The accompanying half-tone and line engraving show the appearance and construction of a very superior erecting floor which has been in use for about three years in the shops of the Canadian Rand Drill Company, of Sherbrooke, P. Q., Canada. The floor, which has proven highly satisfactory, is modeled after a similar one in the American works of the Rand Drill Company, although the one shown contains various improvements in details.

Referring to Fig. 1, the floor will be seen to consist of four parallel heavy cast-iron T-slotted rails, which project slightly above the general floor surface. These rails are bedded upon substantial concrete piers and have their top surfaces planed and set as truly level as possible with the aid of an engineer's leveling instrument. An assortment of rolled I-beams, of various lengths and planed parallel, and of uniform thickness, completes the arrangement.

By a suitable selection and disposition of these I-beams, a floor is produced which is truly level and, what is more important still, of any size suited to the work in hand. The half-tone shows an air compressor of considerable size which occupies the full width and much of the length of the floor; but the floor is just as well suited to smaller work and several small machines may be, and frequently are, in process of erection on different parts of it at one time. The elevation of the machine by the I-beams serves also to improve the facility of access under the cylinders and other parts. If the parts of the compressor are made of uniform h'ght, the mere placing of them on the I-beams insures a correct leveling of the parts and the half-tone shows, in fact, a conspicuous absence of shingles, shims and similar abominations.

Fig. 2 shows details of the cast-iron rails and of their foundations. The rails are in 15-foot lengths, which are suitably bolted and doweled together to insure continuity. They will be seen to be very substantial, insuring a good distribution of the weight upon the concrete piers, which latter are 3 feet deep. At the right-hand end of the piers, a wheel-pit is provided which permits the erection of machines of the type shown, complete with the flywheel, and testing under steam. By means of suitable bolts and clips in connection with the T-slots in the rails, the machine may be bolted down for testing. The smaller machines are thus tested by steam under full load, though how far this practice extends with the growth of size we are not informed.

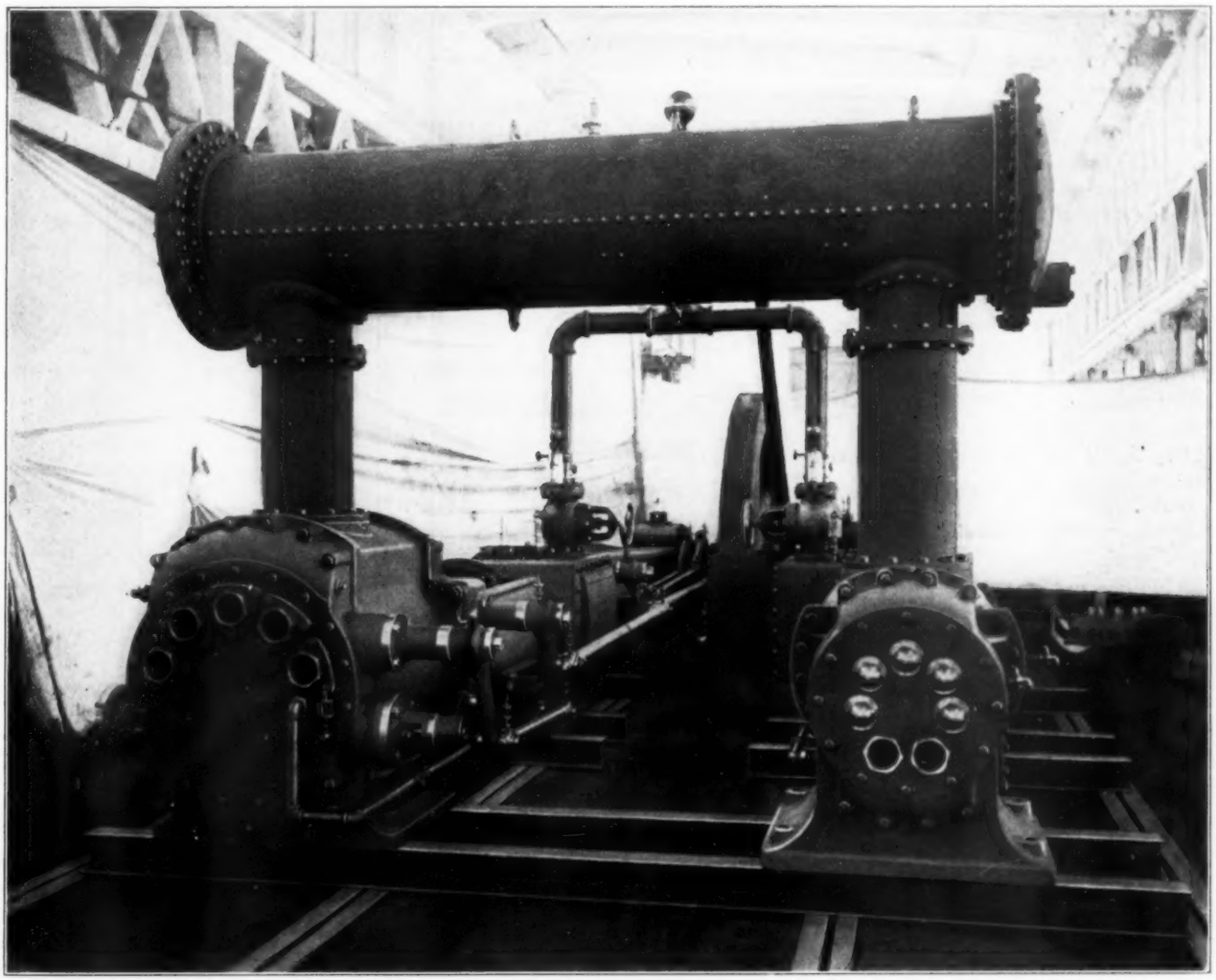


FIG. 1. A CANADIAN ENGINE SHOP ERECTING FLOOR.

Canadian Industrial Development.

Manufacturers and capitalists of the United States are playing an important part in the present business activity in Canada. There is no doubt that Canada is on the verge of a very prosperous era, and the indications are that its progress during the next few years will be more marked than in many years past. Increased immigration, development of its mineral resources, prospects of additional transcontinental and transoceanic freight and passenger service, and a practically protective tariff, are some of the influences which contribute to this optimistic view. Enormous crops of wheat are grown in Manitoba and the great Northwest, and each year a wider acreage is devoted to grain producing. One indication of the development of the country is the recent decision of the Grand Trunk Railway to build a railroad across the continent. This

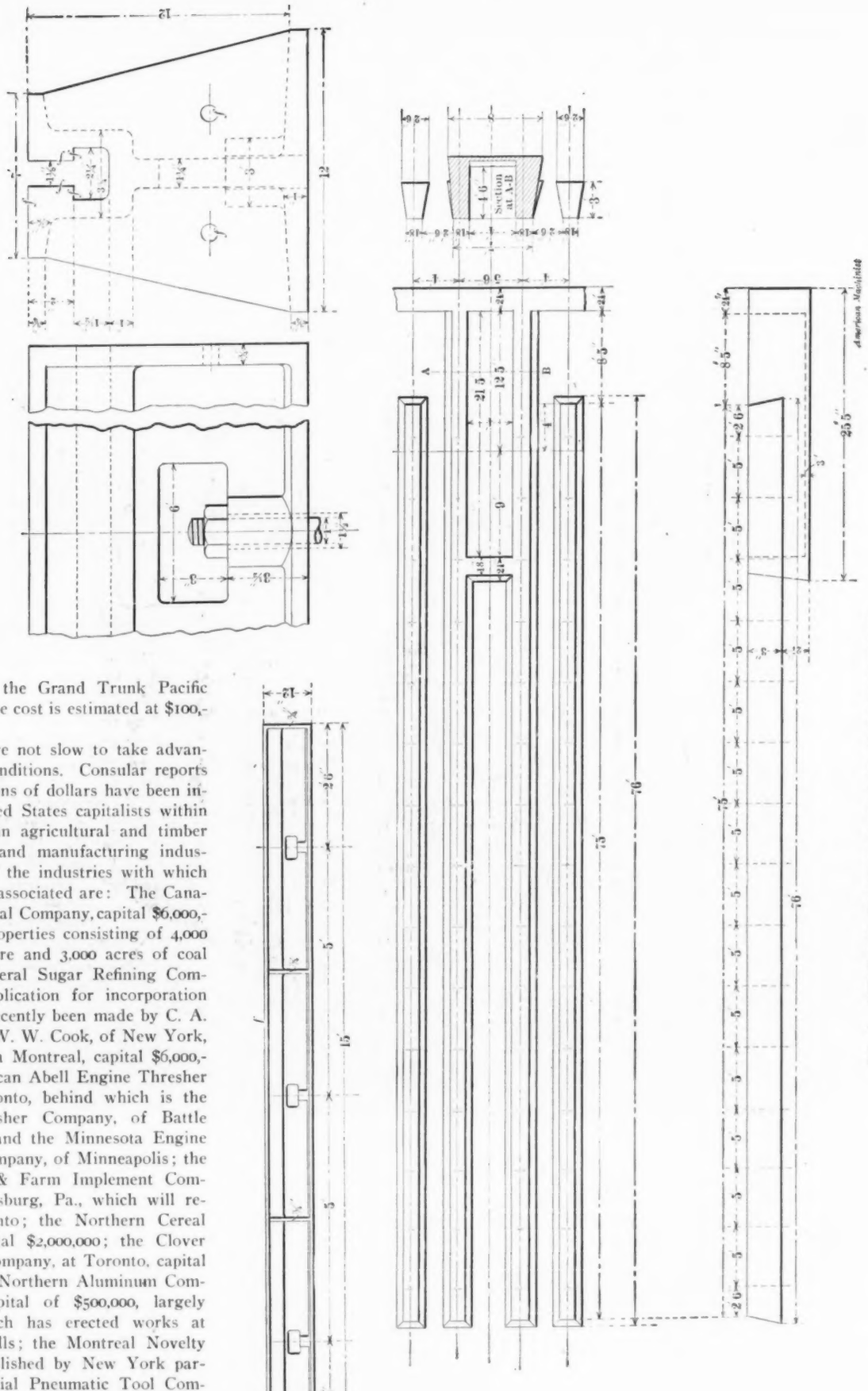


FIG. 2. DETAILS OF ERECTING FLOOR AND OF ITS FOUNDATION.

will be called the Grand Trunk Pacific Railway, and the cost is estimated at $100,000,000.

Americans are not slow to take advantage of such conditions. Consular reports state that millions of dollars have been invested by United States capitalists within the past year in agricultural and timber lands, mining and manufacturing industries. Some of the industries with which Americans are associated are: The Canadian Steel & Coal Company, capital $6,000,000, holding properties consisting of 4,000 acres of iron ore and 3,000 acres of coal lands; the Federal Sugar Refining Company, Ltd., application for incorporation of which has recently been made by C. A. Spreckles and W. W. Cook, of New York, to be located in Montreal, capital $6,000,000; the American Abell Engine Thresher Company, Toronto, behind which is the Advance Thresher Company, of Battle Creek, Mich., and the Minnesota Engine & Thresher Company, of Minneapolis; the Stohl Wagon & Farm Implement Company, of Harrisburg, Pa., which will remove to Toronto; the Northern Cereal Company, capital $2,000,000; the Clover Leaf Mining Company, at Toronto, capital $1,000,000; the Northern Aluminum Company, with capital of $500,000, largely American, which has erected works at Shawinigan Falls; the Montreal Novelty Company, established by New York parties; the Imperial Pneumatic Tool Company; the immense Clergue industries at Sault Ste. Marie, operating iron and steel plants, pulp mills, coke ovens, and nickel mines; the Laurentide Pulp & Paper Com-

pany, Grand Mere, which has a large plant; the Canadian Coral Marble Company, head office at Toronto.

It is reported that the following concerns will locate branch plants in Canada: The Altman-Taylor Implement Company, Peoria, Ill.; the Ingersoll-Sergeant Drill Company, of New York; the Port Huron Threshing Machine Company; the Buffalo Forge Company; the Haines Piano Company, Rochester, N. Y.; the American Bridge Company, New York; the Globe-Wernicke Company, Cincinnati, to establish a branch at Stratford, Ont.; the American Actinolite Company, of New York; the International Paper Company, which holds immense timber areas in the Three Rivers district, to establish large pulp mills. Large investments have been made by Americans in agricultural, grazing and timber lands. A Columbus (Ohio) syndicate has purchased 600,000 acres in the Northwest Territory, and a Minneapolis and St. Paul syndicate a much larger area, and is promoting emigration from the Western States to the Canadian Northwest, where, it is said, over 50,000 settlers have gone during the present year.

In the city of Hamilton alone the following American concerns are locating branch plants:

The Deering division of the International Harvester Company, of Chicago, has purchased a large tract of land to the east of the city and is erecting a plant which, when completed, if present reports are correct, will be of enormous size and will include over twenty buildings. Some of the structures will be between 800 and 1,000 feet in length and the total floor space is estimated at about a million square feet. Work on a number of the buildings is already under way. It is believed that between 3,500 and 5,000 hands will be employed, and a large colony of workingmen's houses is being erected in the vicinity.

The Canadian Otis Elevator Company, a branch of the New York concern, is building a large plant. The Dominion Belting Company, a branch of the American company, is building a plant for the manufacture of cotton duck belting. The Canadian Steel & Wire Company will make wire fencing for the American Steel & Wire Company. The American Car & Foundry Company has located its works in the old Grand Trunk foundry. The Norton Can Company, a branch of the Chicago concern, has purchased the buildings of the Canada Cycle & Motor Company, and if business warrants it will build a tin-plate mill. The Swift Company, of Chicago, has purchased the business and plants of Fowler & Co., and it is said that Hamilton will be made headquarters for its Canadian business. The Chipman Holton Company, a branch of the American concern, will manufacture whitewear and underwear specialties. The Welding Compound Company has also started a Canadian branch in Hamilton.

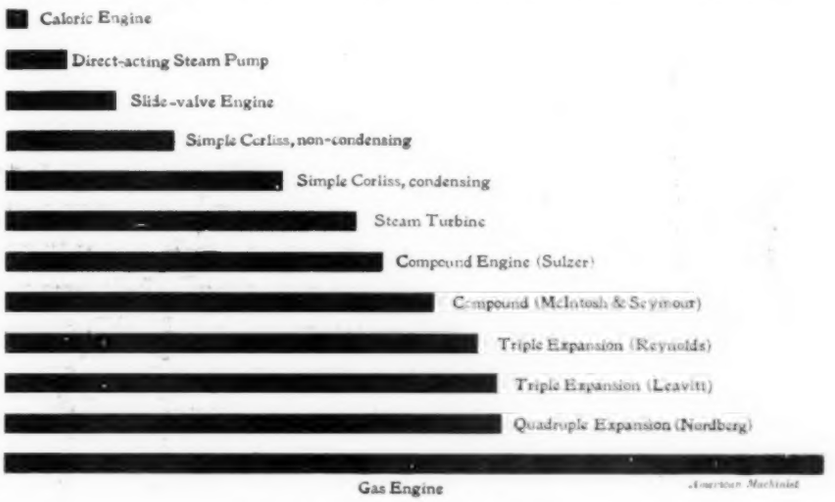
The Westinghouse Manufacturing Company has been located in Hamilton for some time, and manufactures air brakes for the Canadian market for the Westinghouse Air-Brake Company, of Pittsburgh. The Meriden Britannia Company has an extensive plant, at which is concentrated all the Canadian business of the American concern. The Imperial Cotton Company is partly owned in New York and employs some 400 hands. It has a large mill, of most modern construction, and is driven by electric power. The Hart Emery Wheel Company, started as a branch of the Detroit company, has now a large plant for the manufacture of emery and carborundum wheels, emery cloth, etc.

Hamilton is some fifty miles from Buffalo, on Lake Ontario, and has been selected by the American manufacturing firms mentioned as a location for their Canadian branch plants probably on account of its central locality, shipping facilities by rail and water, low rate of taxation, and the cheap electric power supplied by the Cataract Power Company. This company's plant is located at DeCew's Falls, near Hamilton, and will have a capacity, when all the machinery is installed, of about 20,000 horse-power. It is also building a supplementary plant in the city of some 2,000 horse-power capacity. It may be said that extensive additions are being made to nearly all the manufacturing establishments of the city. The Hamilton Bridge Works Company is doubling the capacity of its plant by the erection of additional steel buildings. It will be equipped throughout with the most modern machinery, electrically driven. The Hamilton Steel & Iron Company has made extensive additions to its plant, which has now a capacity of some 120 tons of steel, 100 tons of iron and 200 tons of pig iron per day. The Nickel Copper Company of Ontario has large ore deposits and has erected extensive works. The Sawyer-Massey Company, builders of agricultural machinery and traction engines, is building four large additions to its plant. The Greening Wire Company, one of the largest concerns in the wire business, has completed extensions that will more than double its output. The John Bertram & Sons Company, of Dundas, near Hamilton, has also found it necessary to increase the capacity of its plant in order to take care of growing business.

This spirit of enterprise shown by the city we have mentioned is representative of the whole country. There appears to be a regular revival of industrial interest in all communities, which is well expressed in the following paragraph quoted from a report of the United States Consul-General at Montreal: "Canada is showing wonderful enterprise in self-development. People are throwing off their conservatism. When industrial openings are presented to them they no longer take a year for consideration, but investigate promptly, and when satisfied, invest liberally."

There are many other United States concerns that propose to build branch plants in Canada. By manufacturing goods in Canadian territory tariff discrimination on the products of either country is avoided. There is a tendency also to manufacture in Canada goods for export to South Africa, Australia and other British possessions, and it is obvious that American concerns with Canadian plants will not suffer through any preferential tariff agreement that may ever be established between Great Britain and her colonies.

C.



THERMAL EFFICIENCY OF ENGINES.

Thermal Efficiency of Engines.

The accompanying suggestive diagram is from a recent publication relating to the Koerting gas engine issued by the De La Vergne Refrigerating Company. It is a modern wonder that a gas engine of comparatively recent development should so excel in thermal efficiency the steam engine, which has had a hundred years of lavish experiment bestowed upon it. It is not so cheering when we note how we still waste so much more than we use in

power development. The efficiency of the gas engine as here given is 38 per cent., and 100 per cent. would be represented by a line very close to one foot in length.

High Power Gas Engines at the Dusseldorf Exposition.

BY FRANK C. PERKINS.

Without doubt the great industrial exhibition now being held in Düsseldorf, Germany, has not received the attention in this country which it deserves. The mechanical and electrical exhibits are of the finest character and well worth careful study. The large steam engines, turbines and high-power gas engines shown, particularly the latter, designed for use with blast-furnace gases, are of great importance.

A double working 750 horse-power gas engine of the blast-furnace type is exhibited by the Maschinenbau-Actiengesellschaft, formerly Gebrüder Klein, of Dahlbruch, Westfalen, and Riga, Russland. This engine, shown in the accompanying illustration, Fig. 1. was constructed by Gebr. Körting, of Körtingsdorf, near Hannover. The cylinder is 750 millimeters in diameter and the stroke is 1,300 mm. in length, while the speed of the engine is from 85 to 90 revolutions per minute. Five of these gas engines of 1,000 horse-power for operating electrical generators are being constructed for the new Lackawanna Steel Works now being built in Buffalo, N. Y.

A Körting 350 horse-power engine of this kind was tested by Meyer and found to have a mechanical efficiency of 71 per cent., the mean power indicated in the motor cylinder being 544 horse-power, while the mean power indicated in the pumps was 63 horse-power, giving an effective indicated power of 481 horse-power. The mean power on the brake was 341.5 horse-power, the speed being 101 revolutions per minute, while the thermal efficiency brake horse-power was 23.8 per cent.

Great progress has been made during

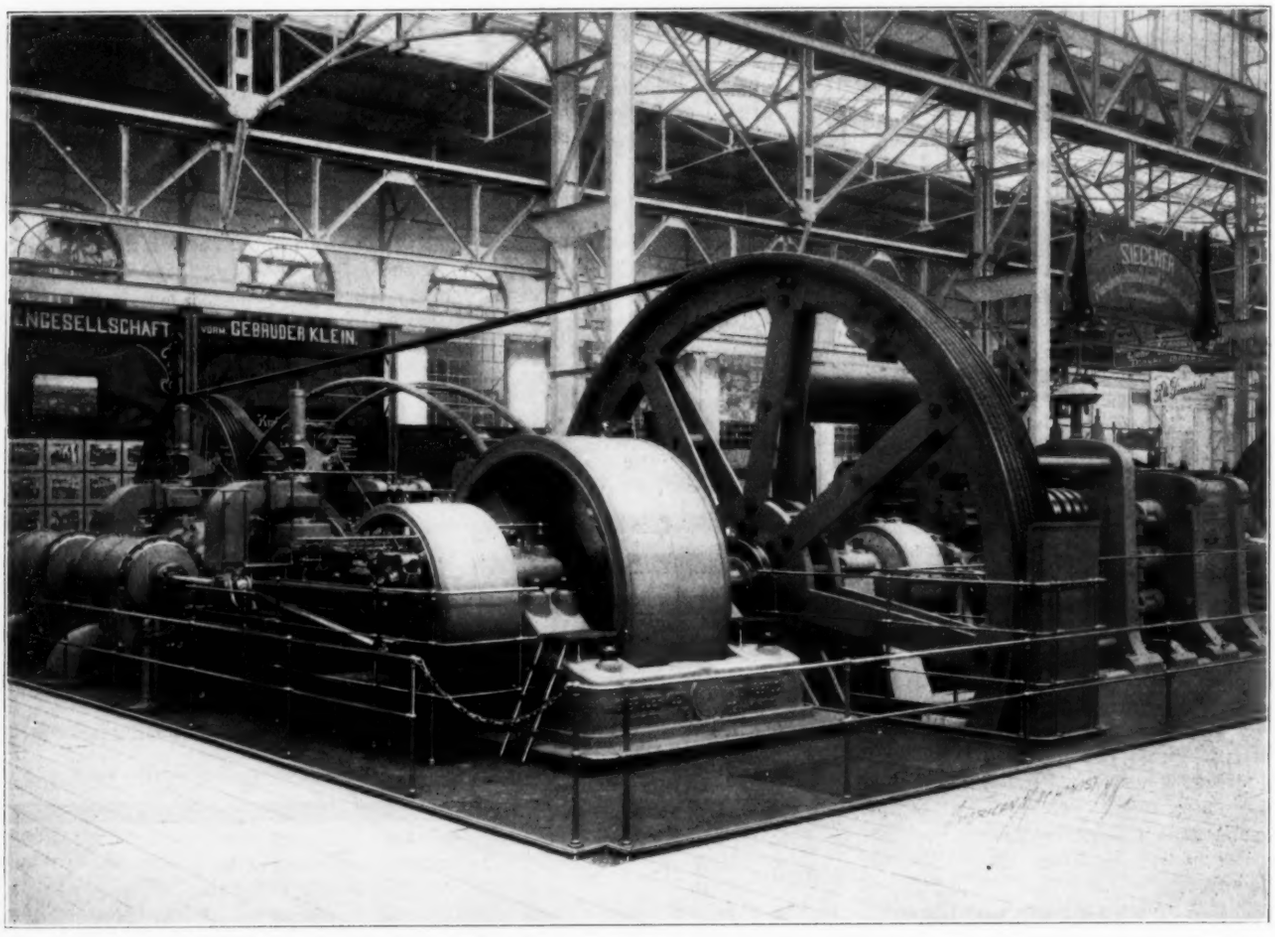


FIG. 1. 750 HORSE-POWER BLAST FURNACE GAS ENGINE.

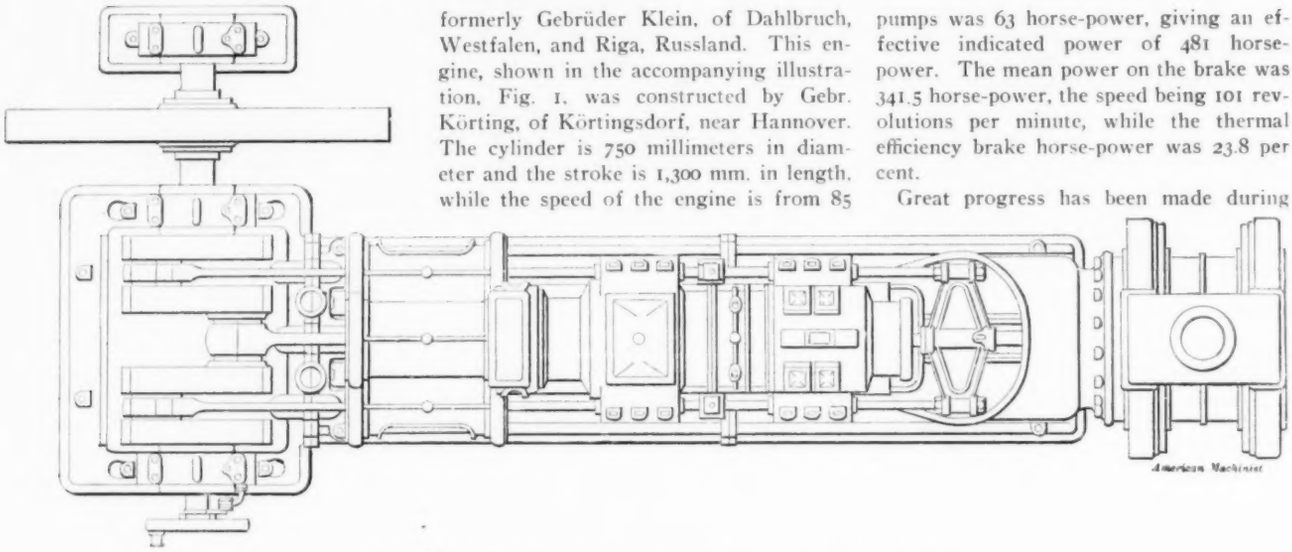


FIG. 2. 800 HORSE-POWER BLAST FURNACE GAS BLOWING ENGINE.

the past decade in the use of gas engines, not only for driving large electrical generators for light, power and traction purposes, but also for the operation of air compressors, pumps and the general operation of machine tools in large manufacturing plants.

On account of the great economy of the high-power gas engines, especially when used with fuel gas and natural gas, it is becoming a great rival of the steam engine and is fast supplanting it in large iron and steel plants, where the blast-furnace gases may be utilized, thus producing a wonderful economy by taking advantage of this waste fuel.

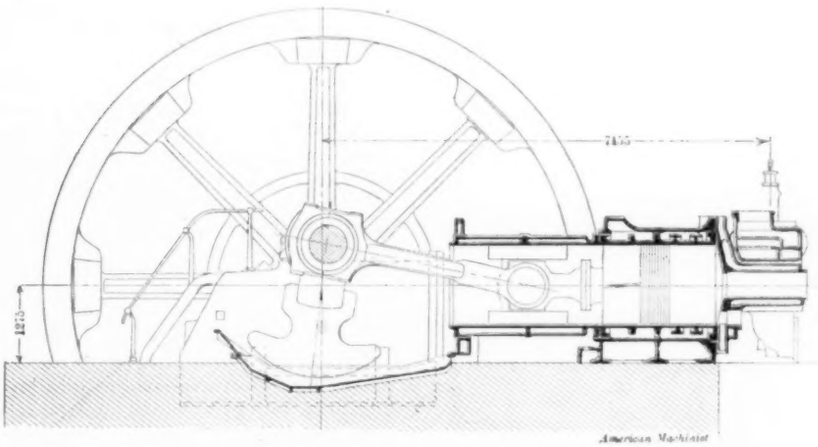


FIG. 3. 750 HORSE-POWER BLAST FURNACE GAS ENGINE.

Among the numerous systems of gas motors which utilize the gases from iron furnaces is the Von Oechelhauser system of two-stage motors. This blast-furnace gas engine, Fig. 2, is used for operating the blowers for iron furnaces and is constructed by the Kolnische Maschinenbau-Actien-Gesellschaft, of Koln-Bayenthal, Germany. One of these engines, of 800 horse-power, is now being exhibited at the Düsseldorf Industrial Exposition. The engine is capable of compressing 17,662 cubic feet of air per minute to a pressure of 7 7-10 pounds per square inch when working at 100 revolutions per minute. Its working cylinder is 30½ inches in diameter and the blowing cylinder is 72½ inches in diameter, while the stroke of both is 37⅜ inches.

The arrangement of this motor consists of the symmetrical arrangement of two plunger pistons working towards each other in a simple cylinder which is open on both ends. These pistons, shortly before reaching their dead points, open successively the different ports—the exhaust port, the fresh air port and the gas inlet.

As the two pistons approach each other the explosive mixture is compressed and ignited for explosion shortly before the end of the compression, thus driving the pistons away from each other and renewing the operation as before. A feed pump is attached to the engine which supplies air and fresh gas, which is compressed in receivers arranged around the inlet ports to such an extent that there is affected a sufficient rinsing of the cylinder, as well as a good mixing of air and fresh gas. The working of the engine can be regulated by the gas admission valve within the limits of 50-100 revolutions per minute and may therefore be suited within a wide range to the different stages of working of the iron furnaces. It will be noted that the cylinder itself has no valve operation during the piston stroke, and the engine is thus of most simple construction, which is so necessary to the conditions of work when using blast-furnace waste gases.

The cleaning of the cylinder is done quickly and effectually after removing the crosshead and piston, the total working space of the cylinder being thus made accessible to its whole extent.

The crankshaft is balanced in such a way that no free centrifugal forces arise. The oiling of the working cylinder is so arranged that in no position of the piston are the oil holes left free by the latter, thus insuring continual lubrication to the pistons as well as to the cylinder walls. The middle crosshead pin is not inside the working cylinder, but in a crosshead brought outside which works in a circular guide, and thus this pin is shielded from the heat and is also very accessible. The feed pump is located under the flooring and is so arranged that its piston feeds with the under side, the air and with the upper one, the gas, to the cylinder. The

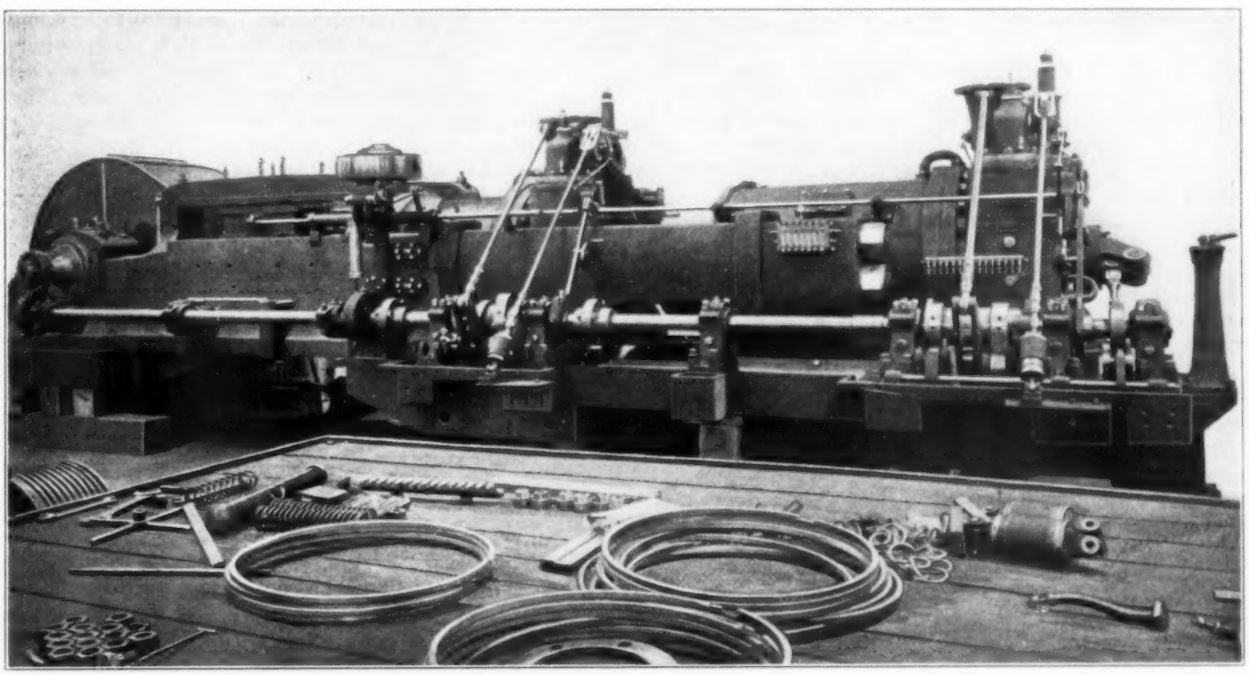


FIG. 4. 600 HORSE-POWER TANDEM BLAST FURNACE GAS ENGINE.

blowing cylinder is fastened with its air chambers to the rear part of the frame of the engine and draws in cold air from the outside.

Blast-furnace gas engines are not only utilized for operating blowers, but are frequently employed in central power stations for driving electrical generators direct connected, as at the electric power installation of the Ougree blast furnaces and steel works in Belgium. In this power plant several 650 horse-power Cockerill gas engines of the blast-furnace type supply the necessary power for driving direct-current generators, whose current is transmitted to a distance for operating electric cranes, locomotives, hoists and other machinery at the rolling mills and iron works of the company.

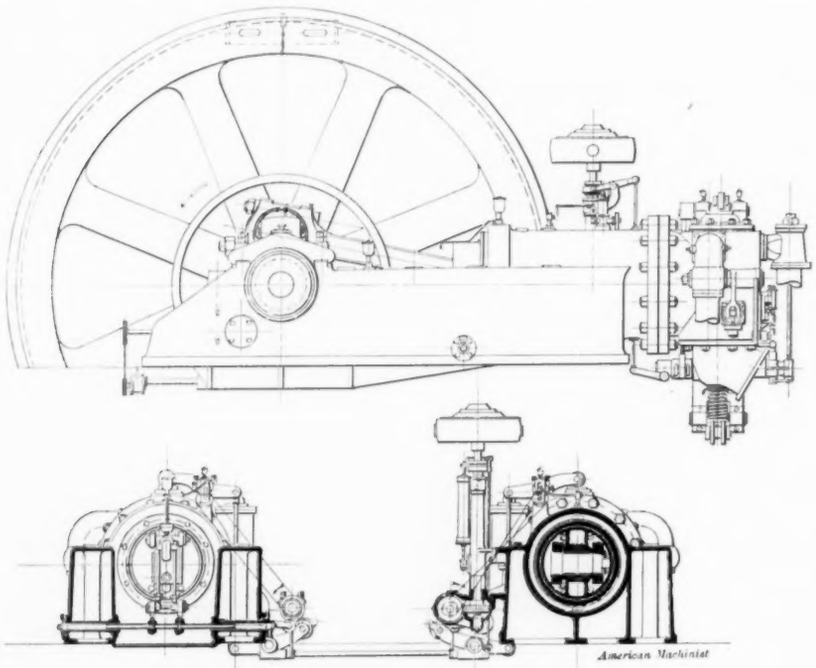


FIG. 5. 350 HORSE-POWER GAS ENGINE.

The Vereinigten Maschinenfabrik Augsburg und Maschinenbaugesellschaft Nürnberg have an interesting exhibit of gas engines and gas generators at the exposition at Nürnberg. The 100 horse-power engine operated by blast-furnace gases has a speed of from 40 to 170 revolutions per minute, while the speed of the 750 horse-power engine is 90 revolutions per minute. This large engine, Fig. 3, drives a direct-current electrical generator constructed by the Elektricitäts-Actien-Gesellschaft, formerly Schuckert & Co., of Nürnberg, and supplies light and power for the Rheinische Stahl Werk, at Meiderick, near Ruhrort. A large blast-furnace gas engine, Fig. 4, was recently constructed by this firm with a capacity of 600 horse-power. This engine is of the tandem type and operates a Drehstrom dynamo at a speed of 120 revolutions per minute. It was constructed for electrical power transmission for the Hüttenwerk Karlshutte, near Diedenhofen-Lothrigen. The cylinder of this engine is 900 millimeters in diameter and the stroke is 1,000 mm. long, while the flywheel has a diameter of 6,400 mm.

At the Düsseldorf Exposition the firm Louis Soest & Co., m. b. H. Maschinenfabrik und Eisengiesserei, of Riesholz, near Düsseldorf, have three important exhibits of steam engines, pumps, compressors, various lines of general machinery and a fine display of large gas engines, including one of 350 horse-power, Fig. 5, for operation with blast-furnace gases, as shown in the accompanying drawing.

This engine is of the double-cylinder type, with a flywheel weighing 26 tons between the two cylinders. The cylinders have a diameter of 650 mm. each and a stroke of 850 mm. an ' the normal speed is 140 revolutions per minute. The total weight of the engine is 76 tons, and it is used for operating a Drehstrom alternating current generator.

There is no question that America is greatly behind European countries in the utilization of the waste blast-furnace gases, but the largest and most complete iron and steel plants now being built are arranging for the use of these large gas engines to be built in this country from foreign designs. In these latest plants, including that of the Lackawanna Steel Company, which has a capital of $40,000,000, electricity will play an important part in every department of the works, from the receipt of the coal and ore at the ships and cars to the handling of the finished product ready for shipment.

A Diagram for Helical Springs.

BY GEORGE F. SUMMERS.

The accompanying chart is for finding the size of helical springs, having given the properties. It also may be used to find the properties from the size, but a table is better.

There are four determining factors for helical springs of circular section, any two of which being given, the other two may be found; they are: The size of the coil, the size of the wire, the carrying capacity, the amount of extension.

To use the chart; find the intersection of the two lines representing the given quantities and from this point follow the other two lines to the edges of the sheet and read off the two required quantities.

Example 1.—Required a spring to bear a maximum load of 2,000 pounds and fit inside a cylinder 10 inches diameter. How long must the spring be when solid to have an extension of 20 inches when free?

Follow along the 2,000 line until it meets the line marked 10 at the bottom of the page. From this point read on the left margin of the page 78-100 inch, diameter of wire, and on the right margin (following up the slanting lines) about 3½ inches deflection per inch of solid hight. Therefore, $20 \div 3\frac{1}{2} = 5.7$ inches solid hight, and $5.7 + 20 = 25.7$ free hight.

Example 2.—Given the size of wire ⅛ inch and the load when solid 100 pounds, what is the diameter of coil, and will the spring give much deflection?

From the underscored figures on the left margin follow across the proper line for .125 until it reaches the curve for underscored 100, and then read from the underscored figures at the bottom of the page .895 outside diameter of coil. The corresponding diagonal is about .95, consequently the spring will expand 95-100 of the solid hight, which is a very fair deflection.

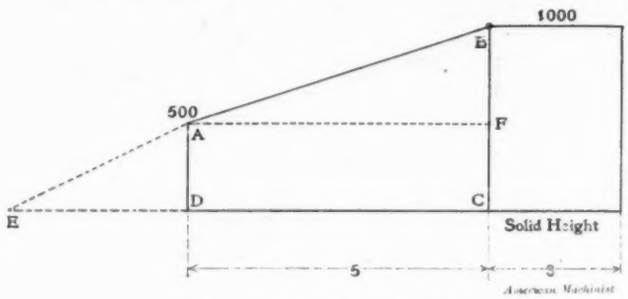


FIG. 2. DIAGRAM FOR A SPRING.

Example 3.—I have a spring of 1-inch wire, 5 inches inside diameter, 20 inches long when free, with 8 coils, but it proves too weak. What size spring shall I put

inside to reinforce it, and what will be the safe carrying capacity of the two combined?

Answer: $5 + (2 \times 1) = 7$ = outside diameter of large coil. $8 \times 1 = 8$ = solid hight of large coil. From the chart; 6,500 = carrying capacity of large coil at 100,000 pounds fiber stress, and the deflection per inch of solid hight = .9. The total deflection thus equals $.9 \times 8 = 7.2$ inches if the fiber stress is not to exceed 100,000 pounds. As the total deflection named was $20 - 8 = 12$ inches, the fiber stress, when the spring is closed solid, will be $100{,}000 \times \frac{12}{7.2} = 167{,}000$ pounds per square inch, and we must look out that the spring does not break when it comes solid with an overload. If a new spring was being designed, it would be better to make the free hight $8 + 7.2 = 15.2$ inches.

Allow 1-16 inch clearance between the two springs (= ⅛ diameter), then $5 - \frac{1}{8} = 4\frac{7}{8}$ outside diameter of small coil. From the point for the large spring on the chart follow down diagonally to 4.875 diameter and read off .695 on the left margin for the wire diameter of the small coil, which makes .6875 (= 11-16) as the nearest commercial size, and from the curve 3,100, carrying capacity at 100,000 pounds fiber

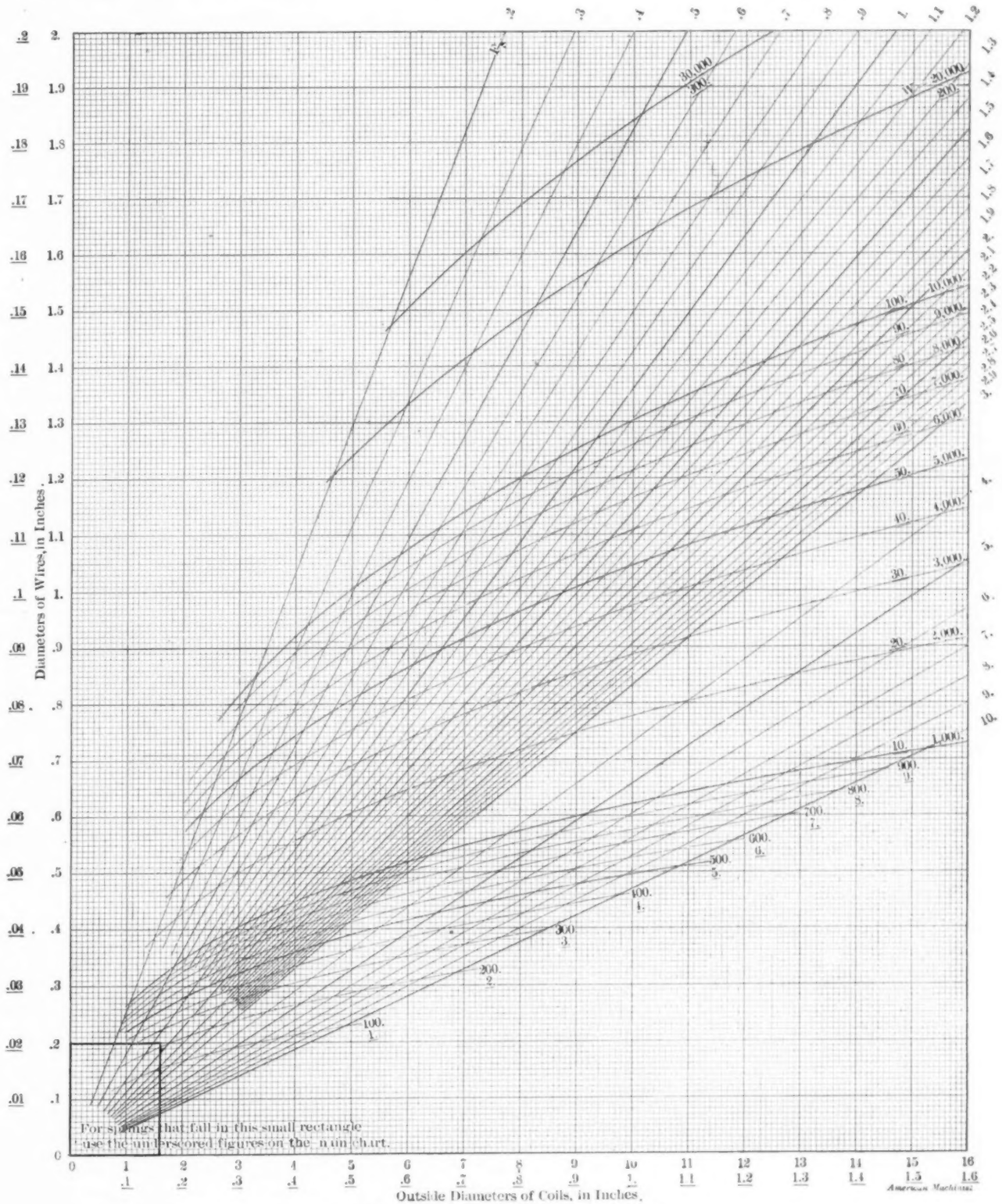

Diameters of Wires, in Inches
Outside Diameters of Coils, in Inches.
For springs that fall in this small rectangle use the underscored figures on the main chart.
American Machinist

FIG. 1. DIAGRAM FOR THE STRENGTH OF HELICAL SPRINGS.

stress. 3,100 + 6,500 = 9,600 total load at 100,000 fiber stress. Use about one-half of this, or 4,800 safe load for the two springs combined. 8 ÷ .6875 = 11.6 coils in small spring.

Note.—Springs that have to work together, either with stirrups "tandem" or "parallel," should start together and end together; therefore they should have the same deflection, and consequently any springs on the same diagonal line may be used together.

Also, springs should be arranged to come solid at the maximum allowable fiber stress as a safety device to prevent their breaking.

Example 4.—Given the spring diagram shown in Fig. 2, which is not drawn to scale, required a spring to fit it.

The vertical distances represent the pressures on the spring, and the horizontal the amount of expansion. The area equals the work absorbed or given out by the spring.

F_s = deflection in inches per inch of solid hight,

E = torsional modulus of elasticity = 12,600,000.

Indexing Drawings and Material.

The system described below has been in use for a number of years, and has given general satisfaction, but as it was devised to meet certain specific conditions it is probable that only the principles involved would be applicable elsewhere. The drawings indexed are of two standard sizes, each size being numbered serially and filed according to number.

The object of the index is threefold: First, to furnish a description of a drawing when the number is known; second, to furnish the number of a drawing when its subject is known; third, to provide a suitable place for recording remarks and data pertaining to drawings.

The last object is so evident that further description is unnecessary. In order to fulfill the first and second conditions, the index has two divisions and every drawing is represented by one or more cards in each division.

In the "Number" division, Fig. 1, each drawing is represented by one card filed serially according to number. The number of the drawing appears prominently in the upper left-hand corner of the card, as shown in Fig. 7, and guide cards arranged as shown in Fig. 1, facilitate reference to the index.

In the "Subject" division each drawing is represented by one or more cards filed according to the subject of the drawing. The arrangement of guide cards for this division is shown in Fig. 2, and as the system is similar to the one generally found in books its use is easily acquired. Cards are located first by the alphabetical position of the noun in the title, and then by the descriptive portions of the title taken in logical order. For example, all cards pertaining to Engine, Type C, No. 306, are located beyond the guide card "Engine" in the left-hand row, then beyond the guide card "Type C" in the second row, then beyond the guide card "No. 306" in the third row.

It is very rare that more than four divisions of any subject are required, and the guide cards cut in fourths, as shown by Fig. 2, have been found convenient.

The "Subject" card for a drawing of the crankshaft of a No. 306 Type C engine is shown in Fig. 3. The matter given in the rectangles of the first line corresponds exactly with the headings on the guide cards, which insures the cards being properly located in the index. The matter on the second line gives the additional indexing information. It is evident that all cards pertaining to that particular engine will be found together, located alphabetically according to the first word of the second line.

It often happens that only one piece is shown on a sheet and that it would be convenient to have all cards relating to a certain division of a machine grouped together. This is accomplished as shown in Fig. 4, which is the card representing the drawing of a crosshead brass in the connecting rod of a No. 306 Type C engine. It is evident that all cards pertaining to the connecting rod will be located together in the catalog and arranged alphabetically according to the first word of the third line.

As it is often convenient to have cards representing similar parts of different machines together, it may be carried out as shown by Fig. 5, which is identical with Fig. 4, except that the second line is placed first and the first line placed third. All cards representing connecting rod parts will be together in the index, arranged alphabetically according to the first word in the second line and then according to the machine in which they are used.

If it is necessary to alter the cards for any drawing, the desirability of easily locating all of the cards representing that drawing is apparent, and it is accomplished

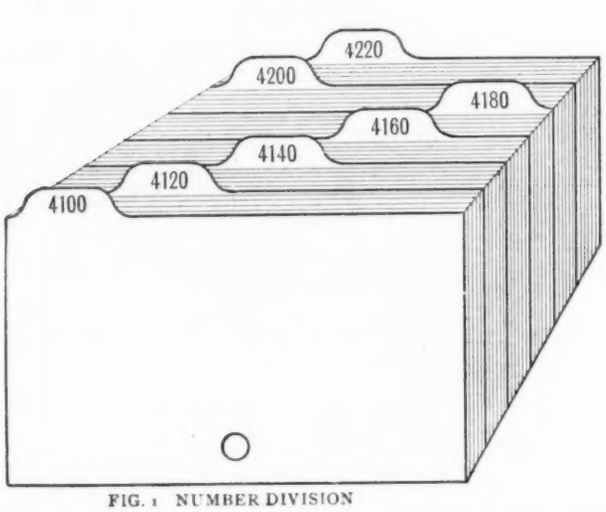


FIG. 1 NUMBER DIVISION

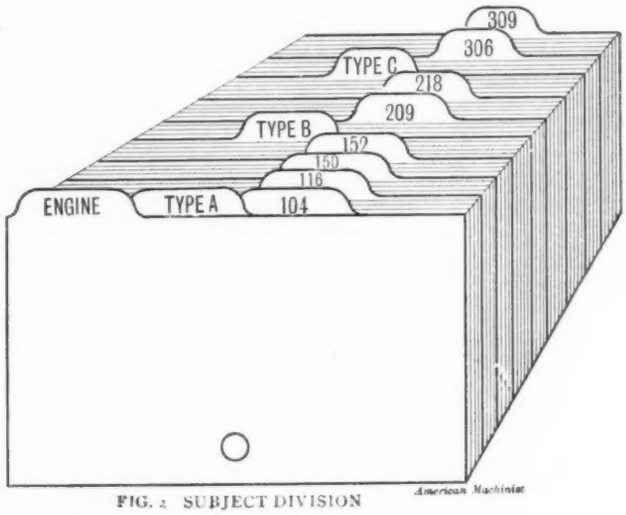


FIG. 2 SUBJECT DIVISION

THE CARD INDEX ARRANGED FOR INDEXING DRAWINGS.

Answer: Continue line $B A$ until it meets $C D$ at E. $E D = \frac{A F \times A D}{B C - A D} = 5$. Therefore $E C$ = 10 = the total deflection of the spring. 10-8 = 1.25 deflection per inch of solid hight.

From the chart the spring must be 3.45 outside diameter by .425 diameter of wire. If great accuracy is not required, make of 7-16 wire and 3½ outside diameter. 8 ÷ 7-16 = 18¼ coils. Free hight = 8 + 10 = 18 inches.

The diagram, Fig. 1, is based upon the following formulas:

$$W = \frac{\pi S d^3}{8 (D - a)}$$

$$F_s = \frac{\pi S (D - d)^2}{E d^2}$$

in which

W = load in pounds when spring is solid,

S = fiber stress in pounds when spring is solid,

= 100,000 pounds per square inch,

d = diameter of wire in inches,

D = outside diameter of coil in inches,

by listing on the back of the "Number" card all of the subjects under which the cards are filed.

Fig. 6 shows the back of the "Number" card giving a record of cards shown in Figs. 4 and 5. Fig. 7 shows the front of the same number card, and the only difference between this card and Fig. 4 is that the line with the number is placed at the top instead of below.

the drawing numbers are assigned, upon a blank exactly like the number card, and when a reasonable quantity have accumulated they are copied and the "Subject" cards made out according to directions on back of the "Number" card.

The system of guide cards shown in Fig. 2, with corresponding rectangles on the top line of the index cards, is also used in keeping a record of the raw material in stock and material purchased. The classification for steel is outlined below:

Steel.	Cold Rolled.	Flat.	Size.
	Common.	Plate.	
	Flange.	Round.	
	Shell.	Square.	
	Spring.		

For example, the heading on a card for shell steel plate, ⅜x60x120 inches, would be: Steel—Shell—Plate—⅜x60x120".

The convenience of the system can only be appreciated by use, and the perfect uniformity in heading the cards will be found to materially lessen the labor of handling.

SUBJECT

ENGINE	TYPE C	NO. 306	
SHAFT	CRANK		

DRAFT	DATE	LOCATION	OUT OF USE	SUPERSEDED BY
41800	8-12-1902		9-15-1902	42360

FIG. 3

SUBJECT

ENGINE	TYPE C	NO. 306	
ROD	CONNECTING		
BRASS	CROSS HEAD		

Bore 3
Length 4½

DRAFT	DATE	LOCATION	OUT OF USE	SUPERSEDED BY
4497	10-7-1898			

FIG. 4

SUBJECT

ROD	CONNECTING		
BRASS	CROSS HEAD		
ENGINE	TYPE C	NO. 306	

Bore 3"
Length 4½"

DRAFT	DATE	LOCATION	OUT OF USE	SUPERSEDED
4497	10-7-1898			

FIG. 5

THIS DRAFT IS INDEXED UNDER THE FOLLOWING SUBJECTS

ENGINE ROD	TYPE C CONNECTING	NO. 306	

FIG. 6

American Machinist

	DATE	LOCATION	OUT OF USE	SUPERSEDED BY
4497	10-7-1898			

SUBJECT

ENGINE	TYPE C	NO. 306	
ROD	CONNECTING		
BRASS	CROSS HEAD		

Bore 3"
Length 4½"

COST

FIG. 7
INDEX CARDS FOR A DRAWING.

An important feature of the system is that when a drawing becomes obsolete the fact is noted on all the cards, as shown in Fig. 3, and the "Subject" cards are transferred to a drawer reserved for the purpose, so that cards in the subject index represent useful drawings only. The "Number" card, however, is not removed as it is necessary to leave this division of the index unbroken for reference.

To facilitate copying the cards on the typewriter they are written in pencil, when

Why it Takes so Long to Build a Naval Vessel.*

BY GEORGE W. DICKIE.

While it might be considered as taking somewhat of a risk to let such a cranky subject loose among the members of this society, yet we will endeavor to give it sufficient metacentric hight to keep the right side of it up, and if it be handled with great care, the building of naval vessels, even in the navy yard, will suffer no more damage from the discussion of this subject than they are likely to suffer afterwards from the building of submarine torpedo boats.

THE SUPERINTENDING NAVAL CONSTRUCTOR

In dealing with this subject the author naturally looks at it through the eyes of a contractor, which to the general public means dishonest eyes. We sometimes think that the Navy Department leans toward the public's estimate of a contractor, else why so many provisions in specifications and contracts to protect the second party, who is stronger, against the first party, who has only his own consciousness of honesty, and his honor as a ship builder, to protect him? In considering certain causes of delay in building naval vessels, the relationship of the superintending naval constructor, or the senior inspector of machinery, to the contrac-

*A paper [slightly abridged] read before the Society of Naval Architects and Marine Engineers.

tor, may, of necessity, require to be discussed, and in this connection the author desires to state that in his opinion, based on a somewhat extended actual experience, no other government can boast of a finer staff of competent naval constructors and marine engineers, in charge of new work under construction for its navy, than that of the United States Navy Department. In fact, the ability of the superintending naval constructor, or senior inspector of machinery, is often quite embarrassing to the simple shipbuilder. We have often been astonished at the almost supernatural ability of the young naval constructor to acquire knowledge on subjects outside of his own profession. Let the bureau of construction and repair, for instance, assume responsibility in regard to certain electrical installations on naval vessels, and in three months thereafter the naval constructors at the various yards will be farther advanced in the application of electrical science to the matter in hand than the contractors' expert, who has given his whole attention for years to this special work. We do not refer to this fact, astonishing as it is, in order to raise any doubts as to its reality, as it must have been observed by others having the same relationship to the young naval constructor as the writer. We have admired this remarkable faculty, because it is so rare outside of those whose talents are exclusively controlled by the navy department. We may have occasion in the course of this paper to appear as intimating that the great ability of the naval constructor often acts as a cause of delay in the building of the ship, and some statements may appear to have a personal tone. It will therefore be understood that no one is meant when anyone is referred to in connection with any part of this subject.

One of the most important causes of delay in the construction of naval vessels is the habit which has hitherto prevailed of designing such vessels while they are under construction. We do not think that it will ever be possible to so design such ships that no change will appear desirable while they are building. It is not necessary that every detail plan should be complete before the structural work begins, but the designs should be complete in every particular, and the specifications should state distinctly how the actual details are to be carried out. One of the most recent specifications issued by the navy department requires that 253 of the most important items in construction should be "built as directed," which means that at the time the specifications were written no one connected with the design for the vessel could write down distinctly just how that design was to be carried out. The shipbuilder would like to carry out the work just as he thought it should be carried out when he made his estimate of cost, but between him and that honest purpose of his there stands the superintending constructor and his numerous assistants, and after them, the bureau they represent. Plans are made, only to be returned over and over again as unsatisfactory, and what seemed plain enough to the simple-hearted shipbuilder when making his estimates, becomes now so complicated that the first year's time of the contract is lost in finding a way to carry out the contract.

DESIGN SHOULD BE COMPLETED BEFOREHAND.

Before the contract is executed the design should be so complete that all structural materials required could be ordered at once, without having to submit new plans for approval. The latest plans from the Bureau of Construction come nearer meeting this requirement than any we have had hitherto. The location and dimensions of every compartment in the vessel should be determined, and should not be subject to change. The dimensions of every armor plate should be shown, and it should be ascertained beforehand that such dimensions are within the manufacturing capacity of the armor makers. The armament should be all finally settled as to amount and location, and the type of all gun ports not only indicated, but practically worked out. The magazines should be worked out in sufficient detail to demonstrate that they will properly stow the amount of ammunition they are specified to carry. All means of handling ammunition should appear on the original design, and in capacity should correspond with the specifications. The arrangement of all machinery should be shown, with all piping and platforms, with a practical plan of getting into and out of machinery compartments. And in all such plans of machinery and boiler compartments, the bulkheads should be shown their actual thickness of 12 inches, with deck beams and coamings that reduce the available space so much. This would save much time later on in rearranging machinery that must go into a space that has been reduced by the framing of its walls. Drainage and ventilation should also be fully worked out, as part of the original design. We understand that in future additions to the navy of the United States something of this kind will be attempted at the Navy Department. If this should be successfully carried out, and there is no reason why it should not be, these vessels will be several months farther advanced at the date of the contract for their construction than has usually been the case, and many changes that have hitherto been necessary, to meet the requirements of the design, will be obviated.

A curious notion has crept into the public mind that the builders of naval vessels are very much in favor of original plans and specifications that involve them in numerous and extensive changes, and it is often claimed that the principal skill possessed by the builder of naval vessels is that of showing changes to be necessary. It is hardly necessary, before so many of these builders, to make any statement in contradiction of this fallacy, but we find that this idea prevails even among shipbuilders who have not had experience with the Navy Department. Changes are seldom proposed now by the builders, unless the work cannot be carried out without them. Nearly all changes are proposed either by the superintending constructor or the Bureau of Construction. These changes not only lose time for the builder, but in nearly every case money also. The board on changes, in fixing the actual cost of any change made, is not allowed to include any margin in its estimate against loss, nor the consequent loss that results from stopping work in one direction and beginning it in another direction, after perhaps several weeks' or months' discussion over the proposed change. And when the board has fixed the actual cost, the builder must accept the amount whether he likes it or not; but if the department does not like it, the board must reconsider its estimates until the department is satisfied.

COMPLETE PLANS WOULD OBVIATE MANY CHANGES.

Complete plans as part of the contract that would obviate all necessity for changes, would not only save much time in construction, but would save much money for the builder as well. The engineering department has fewer changes, and seldom any extra cost over the contract price. This is the result of having fewer representatives at the shipyards, and those have their duties limited to inspection, and not to design; a wise arrangement, both for the Navy Department and for the shipbuilder. Much time would also be saved in the preparation of working details for the shops and yard, if the specifications were carefully prepared from a complete design. In the hull department at present every shop or shipyard detail must be revised by the superintending constructor, not to see if it meets the requirements of the specifications, or carries out in detail the design adopted, but as to whether, in his opinion, it is the kind of design that should be used; and it often goes through half a dozen or so of his subordinates, who each has his own opinion to express in regard to it. These men in many cases have come from the shops or the drafting rooms of the establishment whose work they now have an opportunity to criticise, and in some cases would not likely have been trusted to get out the designs they now have a chance to give their opinions upon.

In general, this system involves the builder in the making of many working plans many times over, before the superintending constructor is satisfied with them. Then they may go to the bureau for final approval; but it does not follow that because these plans have been made and re-made over and over again, until the superintending constructor thinks they

are right, the bureau will approve them, and the work go on. For at the bureau they are subjected to another process of examinations and comparisons with work from other shipyards where similar ships are in course of construction, with a good chance of being sent back for revision, with perhaps copies of plans for similar work that had been approved for a sister ship building elsewhere, and this often sends the poor shipbuilder back to the first plan he submitted to the constructor. Where plans have to be submitted to the bureau for approval, and all plans involving any design have to be submitted, we see no adavantage in such plans being labored on sometimes for months by the superintending constructor and his staff of draftsmen, and by them returned over and over again to the builder, for changes and corrections, then finally sent to the bureau for a similar process, there ending often in disapproval.

Why should not the builder prepare his plans as he thinks will best carry out the requirements of the specifications and the adopted general designs, submit these plans to the bureau through the superintending constructor, who would give the bureau his opinion and recommendation in regard to them? These plans would reach the bureau without being so marred by changes and erasures, and we are satisfied would be as often approved by the bureau as they are now, saving much time and expense both to the builder and to the Navy Department; for a large part of the drafting force maintained by the Bureau of Construction and Repair at the shipyards are employed on this kind of work that is worse than useless.

The detail plans for work under the Bureau of Steam Engineering number about half as many as those for work under construction and repair. Yet that bureau has no draftsmen at the shipyards. Every detail goes to the bureau through the senior inspector of machinery, who gives his opinion in regard to the work shown on the plans submitted. The examination is made by the experts at the bureau. These plans are returned approved or modified, as the bureau considers necessary, then the work goes on. Work is never delayed on account of inability to get approved plans for work under Bureau of Steam Engineering. The reason for this is that the senior inspector does not make any effort to design the machinery details, but simply forwards these details as made by the shipbuilder, with his opinion in regard to them, to his bureau, and no time is wasted in trying to get to a place, the location of which is unknown.

If the designing work attempted by the superintending constructor and his draftsmen were abandoned, and all plans as prepared by the shipbuilder submitted to the bureau with the constructor's opinion in regard to them, one-half of the time consumed in getting out plans would be saved, and many months less time would be required to complete the ship. Besides, the superintending constructor would be able to devote his time to superintending construction, which would appear to be his duty if his title is correct.

SHOULD BE ONLY ONE NAVAL ARCHITECT.

There should only be one naval architect responsible for the design of the vessel outside of her propelling machinery. Now we have three parties trying to do the work—the Bureau of Construction and Repair, the superintending constructor and the shipbuilder—and much time is lost in trying to harmonize the ideas of these three parties to the design. As the Bureau of Construction must finally decide, the time expended by the other two parties is in many cases simply time wasted, and retards construction work on the vessel.

Another cause of delay which especially affects those shipyards situated on the Pacific coast, and far removed from the main sources of material supply, is the rigid requirements of the specifications in regard to the testing and acceptance of materials to be used in construction. It is impossible to order and have on hand every class of material that may be required, and it is quite immaterial in regard to a great deal of the material whether it really meets all of the requirements of the specifications or not. Why should steel material that is under no stress and cannot possibly be brought under any, be tested just as carefully and rigidly as material that of necessity is always under severe strains? We have seen chocks and distance pieces, for which cast iron would be just as good as any other material, rejected, and the work delayed, until other material was obtained that would meet say a high tensile test, when its function in the structure was simply to stand a little compression. We feel sure that in regard to such questions the constructor at a navy yard, where a warship is being built, will be obliged to use a good deal more common sense than he thought necessary to fulfill his duties at a private yard. It is true that the bureaus have always been willing to consider special conditions in regard to the requirements of the material specifications, but such consideration has always meant delay.

We find it very difficult, in a paper to be read before this society, to state all the vexatious delays that occur on account of unimportant materials being required to meet a specification that should not apply to them. We are often told that the very best material that can be produced is none too good for government work, which is very true, if rightly applied. But for ordinary purposes ordinary material should be used, and high-class material reserved for its proper place in the structure. And we feel sure that if we were called upon to take the place at a navy yard building new war vessels, and perform the duties there of the superintending constructor at the private yards, we would not stop the work until some piece of material for an unimportant part of the structure was especially made at the steel works to meet the requirements of a specification, if there was ordinary material perfectly suitable for the work in stock at the yard.

IT IS THE LITTLE DELAYS THAT COUNT.

While it might be claimed, and is often claimed, that to relax the requirements of the specifications where it serves no good purpose to enforce them, opens up the way to their being evaded where it is of the utmost importance that they be faithfully carried out, such an argument against a proper exercise of judgment in meeting the requirements of a specification would lead us to infer that either the naval constructor was incompetent or the builder dishonest, and neither inference would be correct. A specification must of necessity leave much to the judgment of the party who is to interpret it, and the manner in which the judgment is applied will either help the progress of the work or retard it. The little delays that occur every day from this cause, when summed up, will account for months of delay in a three years' contract.

Methods of doing work in the shipyard vary so much in the different yards that much time is often lost by the superintending constructor trying to make the yard practice where he now is conform with the methods he has seen used in other yards where he has been superintending for his bureau. Interference of this kind, however much importance it may have in the opinion of the naval constructor, is sure to cause delay and loss to the builder, without any corresponding advantage to the character of the work. Every yard that has accomplished anything has its own methods of reaching a desired result. The naval constructor should simply require that the result be attained, and his education and experience will be advanced, not by trying to direct, but by watching the methods by which the result is attained. Constructors do not always realize how difficult it is to change the methods of doing work, and cannot understand why the shipbuilder will not consider the methods that he has studied out for doing the work. He forgets that the shipbuilder has also studied out the methods of doing this, in conjunction with many years in the actual doing of it, with the kind, character and breed of men he has to do with, and with a far more difficult problem before him than the naval constructor has to face. The naval constructor aims at only one result—that of satisfactory workmanship. The shipbuilder, if he is to remain such, must not only have as a result satisfactory workmanship, but he must obtain it at a cost not to exceed his original estimate, and if, by interfering with his methods, one of the results only is obtained, the ship may be built and the builder ruined. The best result will always be produced in any yard by the methods that have

become the practice at that yard, and it should never be considered as any part of the duty of a naval constructor at a private yard to endeavor to control in any way the methods of doing work that have grown to be the practice at that yard. If the results desired cannot be obtained by the regular practice of doing work at that yard, then government contracts for the building of naval vessels should not be placed with such a yard.

STANDARDIZATION OF PARTS WILL HELP THE BUILDER.

We have stated that the naval constructor should not be the naval architect, neither should he be the shipbuilder, unless in the one case he is to be responsible for the design, and in the other case he is to find the wherewithal to meet the obligations of the payroll. We have often seen work being prosecuted to reach a certain result in the construction of a naval vessel stopped, because the naval constructor desired to consider the possibility of reaching the same result in another, and perhaps more direct way. There may have been twenty ways by which the same result could have been reached, and work may be stopped for six weeks while the superintending constructor is in search for the shortest way, and yet by the longest of all the twenty days the work might be done in a week. This is no fancied condition existing only in the mind of the writer; it is the normal condition under which construction work is carried on at a private yard, on naval vessels, and it is one of the most serious causes of delay that the builder has to contend with, and the most difficult one to make claim in regard to, as the intention of the naval constructor is to help and not to hinder the work.

We believe that the effort now being made by the Bureau of Construction and Repair to standardize a large number of the fittings used on naval vessels will help the builder in regard to time, as these fittings can be made up in quantities and carried in stock ready for use when the structure is ready to receive them. But we must not expect too much from any system of standards. If restricted to what is generally termed fittings, standards will prove a benefit both to the builder and to the navy in general. The danger in regard to standards is the desire to carry them into a class of work that, from its nature, must be making continual progress in order to meet ever-changing conditions. The standard can never be the best of anything that is ever growing better. When either a man or the thing he makes is standardized, they are dead. The bureau that first sent out standard fittings for electric work on naval vessels is the most changeable in its requirements. New standards to take the place of standards in use come so rapidly from this bureau that it is unsafe to have anything on hand, and we are sure that all the naval bureaus are too progressive to be buried under their own standards.

We have endeavored in this paper to point out some of the reasons why it takes so long to produce a naval vessel under the conditions that force the builder to follow a certain course. We have done so in order to provoke discussion on the subject. We have treated it from our own standpoint—that of a shipbuilder whose works are far from the Navy Deparment. All shipbuilders doing naval work may not be in the same position, although on most of the points raised we think all the shipbuilders are confronted with the same difficulties.

We will be very sorry indeed if anything in this paper should be considered as a reflection on the naval constructors. We know them so well, and they know us so well, that we have no fear that anything we have said in this paper will be misunderstood. In every struggle the writer has had with the naval constructor it has been his misfortnue to be defeated, not because his case was bad, but simply because the constructor's skill was superior to his own. But if we lost our case we never lost our friend in a tussle with the constructor.

Estimating Length of Driving Belts.

In order to quickly and accurately perform some of the work that comes to us in the way of our regular duties, we have made a collection of numerous formulas for estimating the length of belts for power transmission, and have investigated the formulas to determine their relative merits as to the applicability of each and the percentage of error in the results obtained by its application. In all cases considered, the diameters of the pulleys and the distances between their centers were known. The investigation has led to the unearthing, so to speak, of a practical graphical method and a very convenient chart, either of which can be applied to the solution of these problems in belting. It has also led to the derivation of an accurate formula for the length of crossed belts.

The thought that a record of this collection and comparison, with the percentage of variation of each length, obtained by the formula, from the exact length, obtained by actual measurement, may be of interest or assistance to other readers of the AMERICAN MACHINIST, prompts me to submit the same for publication.

The formulas, in the order investigated, are as follows:

(1) Kent's approximate formula for open belts:

$$L = \frac{D + d}{2} \times 3\tfrac{1}{4} + 2C,$$

(2) Kent's accurate formula for open belts:

$$L = R(\pi + .0349\,a) + r(\pi - .0349\,a) + 2C\cos.\,a,$$

in both of which

L = length of belt,
D and R = diameter and radius respectively of larger pulley,
d and r = diameter and radius respectively of smaller pulley,
C = distance between centers of pulleys,
and a = angle whose sine is $\frac{R - r}{L}$

(3) Rankine's formula for cone pulleys applied to solution of length of belt problems:

$$L = \pi\left(\frac{D + d}{2} + \frac{.08\,(D + d)^2}{C}\right) + 2C,$$

in which the letters have the same significance as above.

(4) The Sweet-Smith graphical method for cone pulleys, Fig. 1, applied to the solution of length of belt problems.

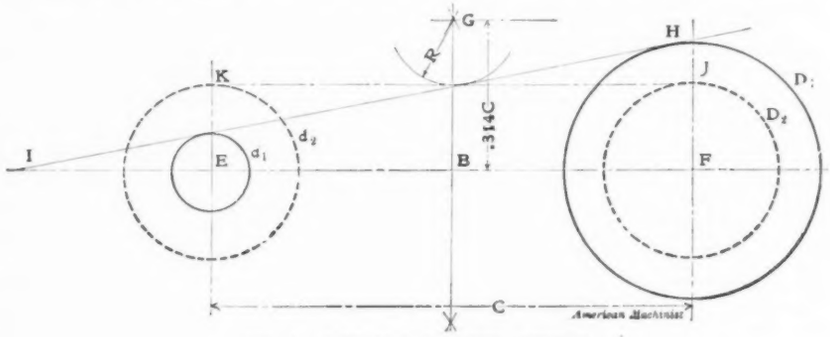


FIG. 1. THE SWEET-SMITH METHOD.

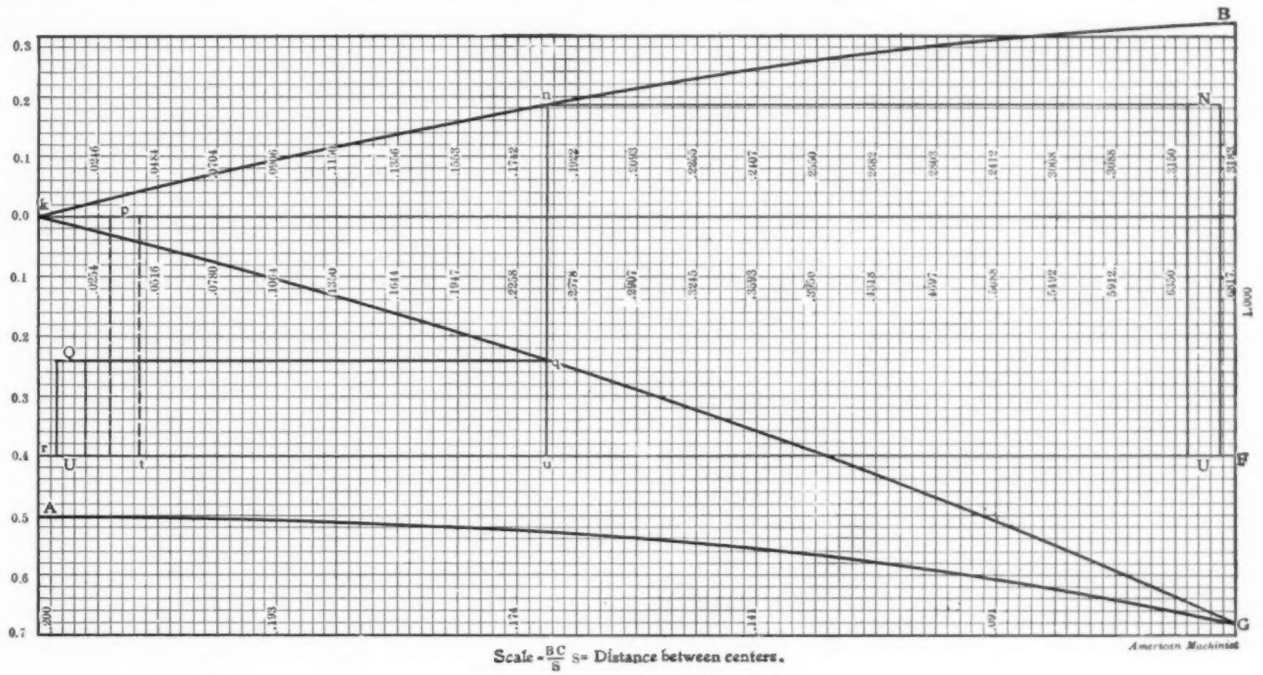
To apply this method, lay off the center distance C, and draw the circles D_2 and d_1 equal to the pair of pulleys. D_1, d_1 and C are always previously determined by known conditions. Draw $H\,I$ tangent to the circles D_1 and d_1. From B, midway between E and F, erect the perpendicular $B\,G$, making the length equal $.314\,C$. With G as a center, draw a circle tangent to $H\,I$. The belt line of any other pair of pulleys requiring the same length of belt must be tangent to the circle whose center is G. Hence, a line, as $J\,K$, parallel to $E\,F$, drawn tangent to the circle with center G, will give the diameters of the equal pulleys D_2 and d_2, drawn tangent to this line from the centers E and F, and the length of belt required equals the circumference of D_2 or

d_2 plus twice the distance between centers, or

$$L = \pi D_2 + 2C.$$

(5) The chart, Fig. 2, for cone pulleys applied to the solution of length of belt problems.

This diagram, Fig. 2, was devised by Prof. Culmann, and used for solving the speed cone problem, but it is quite as applicable to the problem we have in hand, and it is very accurate. When constructed to such a scale that the greatest chord, B C, equals 40 inches, the results obtained from its use will be sufficiently accurate for all cases which arise in practice.



Scale = $\frac{BC}{8}$ S = Distance between centers.

FIG. 2. THE CULMANN DIAGRAM.

To show how the curve may be employed in solving the belt problem, suppose we had given or determined the radii of two pulleys A and B, and the distance S between their centers. If we now take the line $B\,C$ as the linear representative of S, and to the same scale take $Q\,U$ and $N\,U$ as the linear equivalents of the given radii, we can find the radii of equal pulleys requiring the same belt length, by the following process: First find the vertical chord $n\,q$ of the curve $B\,k\,C$, which is equal to $N\,U$—$Q\,U$ of the radii of the given pulleys. From the lower end of the chord thus found lay off $q\,u$, equal to the smaller radius, $Q\,U$, of the given pulleys, and through u draw the horizontal or datum line $r\,u\,F$. To find the radius of the equal, required pulleys we have simply to draw a vertical line from the datum line to the line $k\,r^1$, as $p\,t$. Then the belt required is equal to the circumference of the circle with radius $p\,t$ plus twice the distance between centers, or

$$L = 2\pi\, p\,t + 2S.$$

Another advantage of this diagram is that when once constructed it can be used over and over for all problems that arise. The ordinates of the curve are given for the assistance of any who may desire to construct it. For method of computing ordinates, see article in the "Journal of the Franklin Institute" for May, 1880.

In making the table for open belts, several problems have been assumed and solved to illustrate the variation of results. In this table it is to be observed, first, that Kent's approximate formula (1) is rather a wide approximation, giving results on the safe side—lengths too long rather than too short; second, that Kent's accurate formula (2) and Professor Culmann's chart (Fig. 2) give accurate, reliable results; third, that formula (3) is not at all reliable as here applied; and, fourth, that the Sweet-Smith graphical method gives a close approximation varying on either side of the exact.

Formula (1) is sufficiently accurate and applicable when buying unmade belts. It is also a convenient check on calculations for exact length. The choice of methods (2) or (5) depends upon the individual, but it is to be said for the chart that when once constructed on a large scale it is to be preferred if easy application is desired. It is also a convenient and reliable check on numerical solutions. The percentage of error in formula (3) increases as the ratio between the average diameter of the pulleys and the distance between their centers decreases. The error may be in inverse proportion to this ratio, but a further investigation of this formula as applied here is not warranted. The error in results obtained by using method (4) is due to the small scale employed, and may be entirely eliminated by laying out the problem to large scale. The derivation of this method is recorded in the "Transactions of the American Society of Mechanical Engineers," Vol. X, page 269.

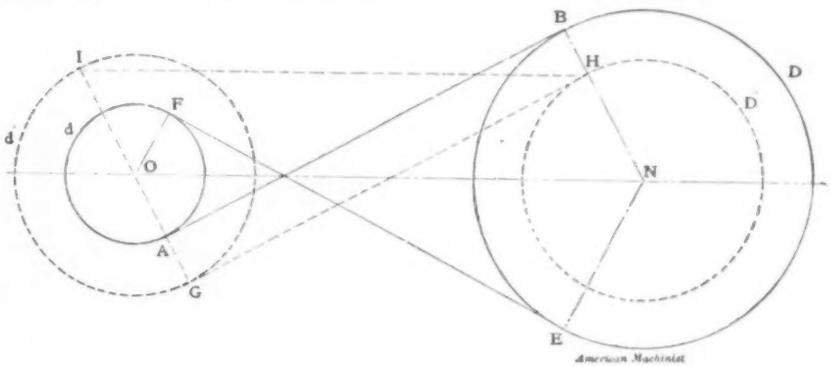


FIG. 3. METHOD FOR CROSSED BELTS.

For finding the length of crossed belts, Kent gives the following accurate formula (7):

$$L = (R + r) \times (\pi + .0349\,\beta) + 2C\cos.\,\beta.$$

in which

L = length of belt,

R and r = the radius of the large and small pulleys, respectively,
C = distance between centers,
and β = angle whose sine is $\frac{R+r}{C}$

Another method is derived as follows: Let D and d, Fig. 3, represent the diameters of two pulleys connected by a crossed belt, whose centers are O and N, respectively. The length of the belt is then $2AB$ plus the lengths of the arcs from F to G and B to E. The arcs subtend equal angles. Supposing each to contain α degrees, the length of the belt $= 2AB + \pi (d + D) \frac{\alpha}{360}$ there being 360 degrees in a circle. Now draw a line GH parallel to AB and through the point H on NB at a distance from N equal to $\frac{NB + OA}{2}$ and about O and N as centers, describe dotted circles whose diameters are d' and D' tangent to GH, representing two other pulleys. Then, for the length of belt, we have $2GH\ (=2AB) + \pi (d' + D') \frac{\alpha}{360}$ But $(d' + D') = (d + D)$, since what was taken from D to make D' was added to d to make d'. Hence the length of the belt is the same in each case. Since NH was made equal to $\frac{NB + OA}{2}$, it follows that the length of crossed belt required for any two given pulleys is the same as the length required for two equal pulleys whose diameters are equal to the average diameter of the given pulleys.

Now continue OG to I and draw IH.
Let ω = angle between OG perpendicular to GH and ON,
C = distance between centers of pulleys,
L = length of belt,
R = radius of larger pulley, and
r = radius of smaller pulley.
Then

$$IH = ON = C,$$

$$D' = d' = \frac{D+d}{2},$$

$$D' + d' = D + d = 2(R + r),$$

$$\omega = \cos.^{-1}\frac{D'}{C} = \cos.^{-1}\frac{(D+d)}{2C} = \cos.^{-1}\frac{(R+r)}{C}$$

$$GH = \sqrt{C^2 - D'^2} = \sqrt{C^2 - (R+r)^2}$$

$$\alpha = 360° - 2\omega = 360° - \cos.^{-1}\frac{R+r}{C}$$

and the expression

$$L = 2GH + \pi (d' + D') \frac{\alpha}{360}$$

becomes

$$L = 2\sqrt{C^2 - (R+r)^2} + \pi (D + d) \times \frac{360 - \cos.^{-1}\frac{R-r}{C}}{360}$$

(7) or

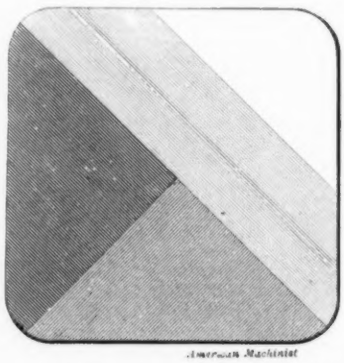
$$L = \sqrt{C^2 - D'^2} + \pi D' \frac{\left(180 - \cos.^{-1}\frac{D'}{C}\right)}{90}$$

I think no one will have difficulty with problems in crossed belts, but if anyone will contribute a shorter or otherwise better method for the open belt problem it will be appreciated. JON.

Curious Experiment in Tempering.

At a meeting of the New York Watch Makers' Society some years ago, a discussion arose as to the value to be attached to the color method in drawing temper on steel tools. The writer at that time made an experiment which is here described by request, without comment. If it serves to bring out expressions of opinion on the subject of temper the object of the writer will be attained.

Take a round or square piece of steel; harden it, and then, after polishing, heat it until it takes a yellow shade. Polish half the plate and heat it again until the polished portion becomes yellow and you will find the part which was yellow is now



CURIOUS EFFECTS IN TEMPERING

red. Then again polish half the yellow and half the red portions and heat the plate until the polished part becomes yellow. You will then find the part that was first yellow—and which afterwards turned red—will be blue, and the second portion which was yellow will now be red, and the polished part will be yellow.

Again polish part of the blue and yellow portions and heat in the same way, and you will find that what was blue will now be gray; what was red will now be blue; what was yellow will now be red; what was polished plain will be yellow.—*Alois Platt, in Sparks from the Anvil.*

Problems.				Result of Solution by Each Method,						Error in Per Cent.				
No.	D	d	C	(1)	(2)	(3)	(4)	(5)	Exact.	(1)	(2)	(3)	(4)	(5)
1	156 in.	84 in	20 ft.	72′ 6″	71′ 10⅜″	76′ 5¼″	71′ 9″	71′ 9⅝″	71′ 10½″	.87	.01	6.35	.17	.01
2	87 "	36 "	25 "	66′ 7⅞″	66′ 3 11/16″	67′ 1¾″	66′ 4″	66′ 3⅜″	66′ 2 13/16″	.69	.11	1.43	.20	.12
3	88 "	40 "	15 "	47′ 4″	47′ 0¼″	48′ 7⅞″	46′ 11½″	47′ 0⅞″	46′ 11¼″	.84	.17	3 67	.04	.28
4	64 "	14 "	30 "	70′ 6¾″	70′ 4 7/16″	70′ 6⅞″	70′ 5½″	70′ 4¼″	70′ 2⅞″	.47	.14	.47	.30	.14
5	144 "	70 "	25 "	78′ 11¾″	78′ 4 11/16″	78′ 9⅝″	78′ 6¼″	78′ 4¾″	78′ 3⅝″	.86	.09	.63	.25	.09
6	110 "	48 "	35 "	91′ 4¾″	90′ 10¼″	91′ 11⅛″	90′ 9″	90′ 10″	90′ 9⅝″	.65	.08	.14	.05	.04

COMPARISON OF RESULTS OBTAINED BY THE VARIOUS METHODS.

Letters From Practical Men.

Warped Celluloid Triangles.

Editor American Machinist:

I wonder if a number of your readers who are draftsmen have not experienced trouble with celluloid triangles warping so that they will not lie flat on the drawing board.

I have a couple that warped so much that I finally gave up using them. Lately I decided to straighten one of them, and, after trying different ways, I finally succeeded with a true surface of wood and a flatiron. I heated up the flatiron till it would soften the celluloid, but not enough to stick to it, and then laying it on the wood just ironed that triangle, first one side and then the other till its back was broken and the strains readjusted, when picking it up I let it swing by the points to cool off even, and it now lies down perfectly level.

Care must be taken not to get the iron too hot or the correct outline of the triangle will be spoiled, and it will have to be trued up again to correct angles.

ERNEST J. LEES.

The Trials of a Draftsman.

Editor American Machinist:

W. W. P. gives at page 1551 a small chapter of the woes of the much-abused draftsman. Your columns have been full of complaints against draftsmen, particularly against those whose education has been obtained through the medium of the correspondence school, and it is truly refreshing to find someone ready to talk out in meeting for the other side.

The average shopman looks on the draftsman as a fellow with a lazy job and a big salary, who hasn't any right to make mistakes. I remember once hearing a criticism which tersely voices the average opinion: "He has nothing in the world to do but sit on a stool all day, and he

hasn't any right to make mistakes." Now, this is just about as true as the Irishman's story: "Oi hev a foine job now. Oi hev nawthin' at all at all to do except to carry bricks to the top av a ladder, an' there's a mon at the top who does all the worruk."

There is no more soul-trying and nerve-racking work in the world than that of the draftsman, who day after day patiently stoops in a most unhealthful position over his work, scheming to solve all sorts of problems in the manner that will be best for his employer and easiest for the shopmen.

When an employer expects a novice to be able to do the work of an experienced man, just because he holds a diploma or certificate of proficiency from a school, it is evidence that the employer has utterly failed to grasp the lessons of experience, and that he is therefore thoroughly unreasonable. Probable he has even been negligent in failing to exercise that wise supervision which seeks mistakes not to find fault with them, but to prevent, or, if too late for prevention, to remedy them.

Some employers try to get too much work from their draftsmen. Haste makes waste in the drawing room far more than any other place, inasmuch as it leads to errors which are costly, simply because they are hard to detect. A mistake on a drawing doesn't look like a mistake, while in the finished work it is all too glaring.

I want to pay the tribute of my respect to the correspondence school graduates. It takes courage and determination of a high order to stick to the work of a correspondence school long enough to finish a course without the incentive of companionship. When a man does complete a course without the encouragement of personal contact with his teacher or the stimulus of class rivalry he is deserving of great credit. While he doesn't know all that he needs to know, he has laid a good, safe foundation on which to erect an enduring structure.

Justice requires an even-handed distribution of praise and blame; so, after blaming the employer who is unreasonable and praising the faithful student, it is but fair to turn to the first angle man. Thank Providence, he is not to be found in many shops.

First angle, while very good as a system of descriptive geometry, is utterly unreasonable as a system for making shop drawings. To look at the left for a view of the right-hand end, and *vice versa*, is not only not logical, but actually very inconvenient. Dozens of times I have seen holes drilled on the wrong side of a center line because of the drawing being in first angle. I have seen tools ground right hand when they should have been left, because that is the way they looked on the drawing in first angle. Usually there is some redeeming feature about faulty systems, but from the shop standpoint the first angle system lacks a single good trait.

W. W. P. certainly deserves great credit for converting those people to the third angle, and doubtless saved them a great deal of money by so doing.

It is fortunate that most employers treat the draftsman with great consideration and make his hours comparatively short to make up for the trying nature of his work, which is even more wearisome than Osborne's man found "bossing" to be.

L. O. DANSE.

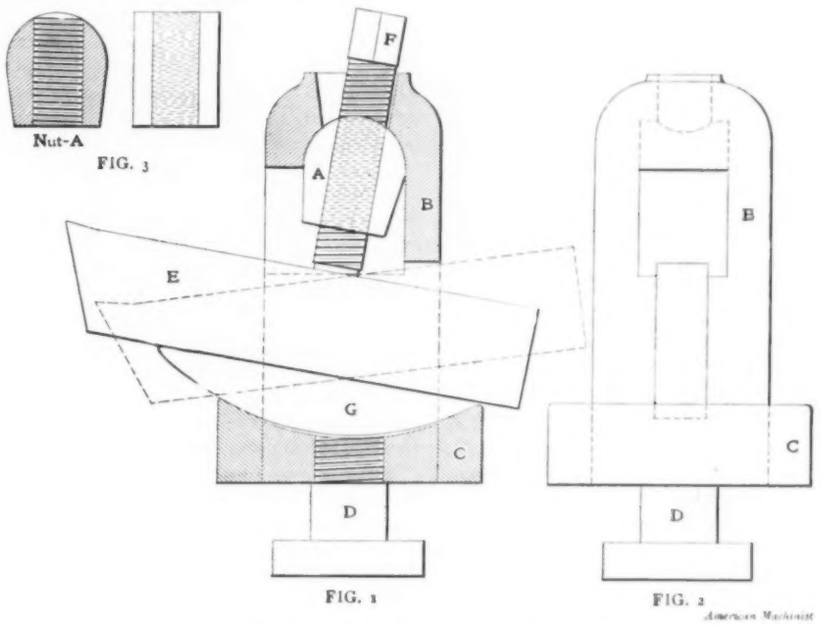
Tool Post for the Pattern Shop.

Editor American Machinist:

The accompanying print shows a tool-post I made for use in pattern and machine shops.

The point of this post is, that no matter what the position of the tool may be, the set-screw has a direct bearing, as can be plainly seen in Fig. 1.

This view shows the post complete with the tool set to the highest point, the dotted lines indicating the lowest position of the tool.



TOOL POST FOR THE PATTERN SHOP LATHE.

Fig. 2 shows the post without the nut, set-screw and tool. The post and nut in this case were made of cast iron, but could be much lighter, and the button *D* cast solid, if made of cast steel.

The nut *A*, Fig. 3, is free to find its own bearing when the set-screw is tightened, and the only finish required is to tap out for the set-screw. It cannot drop out when once put together—thus avoiding a bad feature of several posts I have seen, and has no pivot pins to wear. The nut could be made spherical, but in that case would have to be flattened on one or two sides to prevent it turning.

This post gives very good satisfaction, especially in the pattern shop, as it holds the tool perfectly tight and allows it to be neatly adjusted to the entire satisfaction of every crank of a wood butcher.

E. J. B.

The Draftsman and his Work.

Editor American Machinist:

As the subject is a live one at the present time, I feel like having a few lines regarding the draftsman and his work. "Kabe," at page 1522, gives his views on the subject which appear to indicate a gloomy condition of affairs, but after all, as the editor says, there is quite an amount of truth in what he says.

Draftsmen (by which term I mean men who can design from crude ideas a practical machine) rarely receive their just amount of credit. They are generally considered to be a necessary evil by a great number of machine builders, while really the success of the business depends largely on them. Workmen, as a general rule, take great pleasure in finding errors and reporting them to headquarters, and rarely tell the draftsman about the neat and workmanlike manner in which his scheme worked out or how easily his drawings could be read.

Another source of displeasure to a great many draftsmen is their inability to see the fruits of their labor in actual work, and regarding this point I would like to describe our practice which we have followed for several years with gratifying results.

One way to encourage a thinking man is to put some responsible work in his charge and give him full sway. In our place, if an inquiry comes in asking for a price and full information regarding a certain machine which is not one of our regular productions, we detail a draftsman to look after the matter. His duty is to call on the prospective buyer, ascertain his wants and secure full data relating to same, from which a price is quoted. If the order is secured, the draftsman follows the matter up, being given full charge of the work, making his own drawings and following

the course of construction in the shops. He is thus put in actual touch with his design and is often able to see points which can be improved, thus not only increasing his own knowledge, but adding dollars to his employer's capital.

We have found that in a great many cases a draftsman is able to have several operations in hand at once and give each its needed attention. He is thus enabled to see the fruits of his labor and often correct errors without any serious consequences. The plan gives to the draftsmen an increased feeling of confidence and satisfaction. This scheme may to some seem rather queer, but it is sure to reap its benefits upon application, to save hours of time and prevent the draftsmen from the annoyance and uncertainty of receiving data after they have passed through quite a number of hands.

"Kabe's" term "engineer" puts me in mind of our experience in using the same word, which is the same as his. If you say you are an "engineer," nine out of every ten persons will think that you operate a steam engine. The other week we 'phoned to a large concern, asking them to call and see our "engineer" in regard to quoting us a price on a large contract. Upon arrival he asked to be shown the engine-room, and started to ask the steam engineer what was wanted, who of course did not know and sent him up to the proper personage.

Such experiences as these have prompted us to drop the word except when talking to engineering men. We instruct all inquiring friends to ask for the drawing-room. S. P. Y.

Drawing Sheet Metal Shells.

Editor American Machinist:

At page 1686 you have an article called "The Modern Method of Drawing Sheet Metal Shells," which embodies a criticism of the methods used by Mr. Woodworth in a previous article which it was my misfortune not to have read.

In the first place, the methods of "Experience" are anything but "modern" and are, as we would call them, "old style." The way in which he builds his double-action dies is not quite as economical as he says, for the reasons that the different parts of the die are made to templets, which in itself is a costly proceeding and requires considerably more time to make than by the simple, "old-fashioned way" in which we build our double-action dies, which are made in two different ways: the solid cut-and-draw die and the ring die.

The "solid" cut-and-draw die is very seldom made by us, and never to any greater diameter than 5½ inches at the cutting edge. The punch block *A*, Fig. 1, is made in three sizes, of cast iron, and is usually when finished from 2 to 2½ inches thick. The casting is faced on the back and on the upper surface of the flange, and afterwards is bored to insure a tight driving fit for the die *D*, which does not require any other fastening to hold it in the punch block and never pulls out in stripping the shell.

The die *D* is made in the usual way, of tool steel of sufficient thickness, machined to allow for grinding after hardening, and is firmly driven into the punch block.

Where "Experience" uses a cast-iron punch-holder we use what is called a "combination forging" of wrought-iron base and tool-steel face, which latter is usually about 1½ inches thick. This forging is machined flat on the back, and after being bored the plunger is turned to size, faced off smooth and left soft. We have found that a punch of this sort is cheaper and more easily made than the built-up punch which "Experience" advocates. The cost of forging and labor is considerably less than that of a cast-iron base and tool-steel center, with the additional labor in fitting the latter to the former. The presses we have here that are supposed to take the planed back, as per "Experience," have been permanently altered to take nothing but a flat back punch.

Fig. 2, the "ring" die, is familiar and scarcely needs detailing, but "Experience," and possibly others, may see the benefits of this tool as applied to its many uses. The die or cutting edge consists of a combination forging (wrought-iron base and tool-steel face welded together), machined as shown, into which can be screwed various double-action rings, combination centers, the shells of which require the same blank, and also at a pinch used as a blanking die.

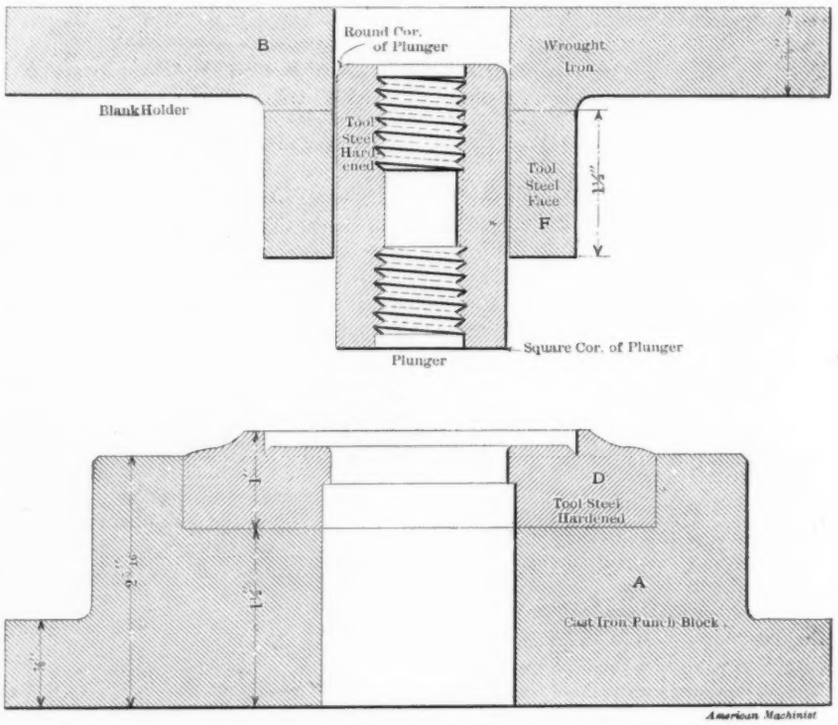


FIG. 1. SOLID CUT-AND-DRAW DOUBLE-ACTION DIE.

The ring is usually a "combination" forging fitted as per Fig. 2, and it can be either a double-action or combination center. The double-action punch is made same as for Fig. 1.

We have and use here dies of this sort for both double-action and combination work, the cutting edges of which range from 1 to 16 inches diameter. We have found these far superior to the solid, built-up die, as the work for each cutting edge is greater in enabling us to draw both double-action and combination shells.

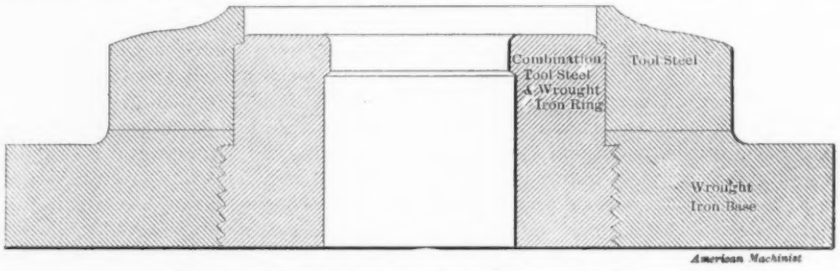


FIG. 2. RING DIE WITH DOUBLE-ACTION DRA WING RING.

The plungers are always made of tool steel hardened, and, as every toolmaker *ought* to know, must have air holes. These plungers are usually about 2½ inches long and have a ¾-inch standard thread cut in

each end, which enables us to use either end of the plunger for either a square or round cornered shell, as per Fig. 1. These plungers are used in connection with what we call "stalks," made in various lengths and diameters to cover everything in double-action work.

I do not agree with "Experience" in his definition and use of the "reducing" and "re-drawing" dies, when he claims that a reducing die is only to partly reduce a shell, and that the re-drawing die is to reduce all the way. There he is wrong. For example, we had drawn a shell, 6½ inches diameter by 2¾ inches high, and had to bring or reduce the same to a 5-inch diameter straight shell. Would we "re-draw" this first shell once or a half-dozen times, which, according to "Experience," would have to be done in his "re-drawing" die? Could he re-draw ¾ inch on the wall in any such die all at once? No. He would have to shove this shell through three or four times and not move more than ⅛ inch on the wall with any semblance of a good job.

This is where the double-action reducing die is just the die for the job. With a die of this sort the ¾ inch on the wall, or, in other words, a reduction of 1½ inches in diameter is very easily done, and if a particularly nice, straight, smooth shell is desired I would then shove them through a die similar to the die called by "Experience" a "re-draw die," and by us a "sizing die," and not move more than 1-32 inch in diameter.

We make for a certain party a shell of No. 24 gage brass, which when finished is 2¾ inches diameter by 8½ inches long, which is made in one draw, two double-action reducing, one "sizing" and two annealing operations. Each of the operations is shoved through and we have no difficulty in stripping the shell. By doing the job in this fashion there is practically no loss at all, as we make many thousands of these shells and have not lost, on an average, more than a dozen to each thousand.

It was my pleasure (and at the time anything but pleasure), not more than three months ago, to make up for a New Hampshire concern an order of 300 steel shells, 2¾ inches outside diameter by 5 inches long, of 3-16 inch stock. At the start it caused me considerable trouble and annoyance, as it was a job the like of which had never been undertaken here. After trying in vain to obtain the very best material suitable for the job (3-16 inch O. H.) we finally had to use the common run of "B" steel. After spoiling about two dozen shells in finding the blank, experimenting with stock and tools, we finally ran the job through. The job was done in one draw, two double-action reducing and one sizing, and three annealing operations. We experienced considerable trouble in stripping and pulling the shells off the different plungers, and finally had to equip each die with what are called "spring stripper pins." Had no further trouble after that. This job was done *cold*. The die was made of cast iron, with a hardened steel drawing ring firmly driven into the punch block and an old blank holder of cast iron that was "dead." The reducing dies were made in the same way, except that the approach to the mouth of each die and also the blank holder was tapered at an angle of 30 degrees to insure the iron going under easily.

The "re-draw" die, as per "Experience," is not used by us at all, except to "size" the shell, and then we never move more than 1-32 inch diameter. Everything from 3-16 to 1 inch reduction on the wall is done here double action, and where the reduction is less than 3-16 inch on the wall with a combination reducer, and we have no reason to complain, as we use any and every kind of material on the various jobs we have to do here.

Regarding the use of cast iron for drawing dies, we have and use here a large number which are entirely satisfactory in every respect, and they are made for and used on all sorts of materials. As a matter of fact, every large job that is done here from incubator parts of No. 28 brass to an ordinary house sink of No. 14 iron is made in cast-iron dies. We are running quite a number of complete sets of dies made entirely of cast iron—die, blank holder and plunger—and as some, and in fact nearly all, the work made in these dies is inspected by the parties receiving the same and none have been returned, ought to speak somewhat favorably of cast-iron dies. Some of these dies have been running for years and only require at times to have the face of both blank holder and die re-made.

It depends entirely on the toolmaker who makes a double-action die to be careful in boring both die and blank holder perfectly level, and, if anything, where a deep draw is desired, in giving the blank holder a trifle more pressure toward the draw than on the edge of the blank.

I agree with "Experience" regarding the setting of double-action dies that the man, whoever he is, must understand his business, and there we are fortunate in having just the right men and our dies seldom shear and the shells are as near even as it is possible to draw them.

Regarding his preference for a "cam" press, my experience has been just the opposite way, as we have both cam and toggle presses, large and small, and we get the best results from the toggle press. They very seldom shear and have a larger range of adjustment than the cam press.

The scope of work done here is so large, every kind of material being used, from aluminum to iron ¼ inch thick, that I have every opportunity to observe the respective life of each tool, and there is *no* scrap pile except of some that were bought.

My object in writing this was not merely to contradict some of the methods of "Experience," but to show how different each shop is from the other in the making of tools and dies, the material used in making same, and the results from each.

A. C. R.

Perpetual Motion Experience.

Editor American Machinist:

Mr. Booth's article about perpetual motion, at page 1673, brings to mind its prominence in the early years of my life. My father had a shop and a large portion of my childhood days was spent in it, and among my very first recollections are conversations about perpetual motion. The subject seems to have occupied the mechanical mind of that time more than at present, and, as I well remember, it was much discussed. Every blacksmith, millwright or carpenter who had inventive ability studied and talked on the subject, and I recall a number who went so far as to begin models, some of which fell into my hands as much desired property. One man spent considerable time one winter making light gearing by casting racks of pewter and bending them around wooden wheels, but he never perfected his machine.

As I remember, most of them were in their simpler form a hub and bearings and an odd number of arms with easy shifting weights which would approach the hub on one side while they were going up and run out to the end of the arm as they went down, and, being an odd number, the odd one would be pulling it around. Some proposed hollow arms with balls in them, and one man thought of quicksilver in the arms. The simplest thought of all was to have the arms hinged to a many-sided hub where they would hang limp on the one side and project out *radiant* on the other. "It's bound to go," they would say.

My father was a good mechanic and ours was the only machine shop within thirty miles and a gathering place for all the mechanical clans and headquarters for discussions, and he generally smiled at the different ideas and efforts that were being made, but even he was not proof against the infatuation, and at last became keenly interested and spent some time on a model.

It was quite late one Saturday night when he got it together, and he was considerably surprised at its not going, especially after he pulled it around a few times (as we now do to the gas engine). I was probably eleven or twelve years old at the time and I held the candle for him to work by, and I confess I lost considerable faith in a man that I had previously believed could make anything go. Father set the machine away on top of a high bookcase and we went to bed. He was looked up to and considered a staunch Sabbatarian, but when I came down stairs the next morning I found him with the model in his hands, making the final study of it. I never knew just what conclusion he reached, but the model soon disap-

peared. It was only a few weeks after when an old friend came to the shop, who had been stricken with the same fever and was sure he had found the solution of the problem. I heard father say, "It's of no use; it looks all right, but when you come to put it together everything seems to balance and it won't start."

Soon after that I began studying Comstock's Philosophy in school, and among the first lessons I learned was that *inertia* was a natural property of matter, and I thought: That's the reason perpetual motion won't work. When I got further along in the book and came to hydraulics, and learned of the Archimedean screw and varieties of water wheels, one night when I was driving the cow home from pasture, I had a vision of a water wheel driving a screw and pumping up water to drive the wheel, and was sure I had perpetual motion. I did not have time or skill to build my machine, but I felt satisfied it would do the business.

I must mention one thing with this story—the caution with which almost every man divulged his idea for fear his thought might be made public before he could perfect a model and get a patent, and another thing was the wonderful value of a patent.

Some forty or more years ago I had the delightful privilege of seeing the Ravel brothers in one of their pantomimes, where the black knight and harlequin were constantly striving to get the better of each other, and when the knight was hurrying across the stage the harlequin struck him with a club and knocked him all to pieces. The latter got his friends together and in dumb show rejoiced over his victory for a moment or two, and then began gathering up the pieces of his rival. He first set the legs up against the rear of the stage and carefully balanced the trunk on them, and severally hung on the arms and then picked up the head and leered and made fun in the defunct face and proceeded to top out the structure, which he had no sooner done than a complete resurrection took place. The whole thing became suddenly animate and scurried off the stage, completing his interrupted escape. That's just what will take place when the real perpetual motion is made. It will only need a governor and automatic brake. It is so long a time since I had thought about the subject that I supposed it was entirely out of men's minds. F. P. Avery.

The Annual Meeting of the National Civic Federation.

The meeting of the Industrial Department of the National Civic Federation at the rooms of the Board of Trade and Transportation, of this city, December 8, 9 and 10, was a notable success. The audience room was well filled at all the sessions and the interest was well sustained until the last. Senator Hanna was the presiding officer. At his right, during the sessions, sat Mr. Gompers, president of the Federation of Labor, and at his left, the ex-U. S. Minister to Turkey, Mr. Straus.

At the opening session Mr. Gomper's chair was occupied by Mayor Low, who was introduced by Senator Hanna and who made a brief address of welcome. After this address of welcome, Mr. Alfred Mosley, who was instrumental in bringing the English delegation of labor leaders to this country, was introduced. Many of these delegates, including Mr. John Barnes of the Amalgamated Society of Engineers, were present and made a most favorable impression. Mr. Mosley stated that, while English born, most of his life had been spent in South Africa, where the work of American engineers in connection with the gold mines had first directed his serious attention to America and to American methods. He paid a remarkable tribute to these engineers and gave an excellent example of the ability of the Englishman to say nice things about us, some of which were controverted in the subsequent discussion. One of his complimentary statements, which was confirmed by some of the English labor leaders, referred to the fact that greater encouragement is given here than in Great Britain to suggestions by workmen. This and the greater provision of free public schools were considered to be the chief tangible differences between the workingman's condition here and there. Mr. Walls, general secretary of the blast furnacemen's organization, and Mr. Barnes agreed that it is very easy to exaggerate the differences between the conditions surrounding the workingmen in the two countries. They had seen many things that are different, but were not prepared to admit that our way was always the better. It was very obvious that these men have had their eyes open and it may reasonably be expected that when their report appears it will be in the highest degree interesting and instructive. All expressed the highest appreciation for the courtesy and liberality with which shop and factory doors had been opened to them everywhere.

Mr. Charles Francis Adams was scheduled for the first address of Monday afternoon, but his train was late and Archbishop Ireland was introduced. His address, while highly interesting, was general in character and scarcely capable of satisfactory reproduction in abstract. Following the Archbishop Mr. Carpeneter, of the National Cash Register Works, was introduced. His paper related chiefly to the organization of a labor department in industrial works. He considered that capital should be organized much as labor is now organized, and at later sessions this idea received much attention. He considered that labor must organize in order to secure the best wages and that capital must organize in order to secure the best return for the wages paid. Apart from this consideration, however, he considered a labor department in all large works of the highest importance. He considered that a leading cause of friction was the fact that the entire administrative force intervened between the workman and the employer. Because of this the workman's views and complaints were apt to be, consciously or unconsciously, highly colored when they reached the employer. In many cases requests which, if coming at first hand, would have been granted are, under the existing organization, refused in order to uphold the authority of foremen and others who have already refused them. The labor department urged by him should consider all complaints from the men. Its investigations should be thorough and its actions prompt. It should have charge of the wages question and should keep records of the work of individuals and should have power to check discharges by foremen from spite or other unworthy causes. It should encourage good workmen to join the unions and have no animus against shop committees, in order to encourage the presence of the best men on such committees instead of the worst, as is now often the case.

Following Mr. Carpenter's very interesting paper came an address by Mr. D. C. Sachs, formerly secretary of the Street Railway Commission, who discussed arbitration as related to public service corporations. He opposed compulsory arbitration in general, but considered that the case of public service corporations was an exception to the general rule, because of the importance of uninterrupted service to the public, and because these corporations operate under public franchises. He hence considered it entirely proper that those franchises should contain clauses requiring such corporations to submit all differences between themselves and their employees to arbitration. Should this be considered too radical, he thought it proper for clauses to be inserted specifying the minimum of wages and the maximum of hours.

Mr. Adams had arrived during the delivery of this address, and was introduced. He read a carefully prepared paper, advocating his well-known scheme for compulsory inquiry into the causes of labor disputes. He deprecated compulsory arbitration, but considered that a commission of inquiry, with power to compel witnesses, but with no other power beyond that of publishing their findings and recommendations, would by making public the facts give public opinion a chance for intelligent formation and lead, in most cases, to speedy settlement of disputes. He believed that such a commission should be appointed for each case as it arose, and should then dissolve. In the few cases in which settlement would not follow these proceedings, he believed it advisable that they be fought out.

Mr. Adams was followed by Mr. McMann, Labor Commissioner of New York, who referred to the denial by the employer in many instances of the right of his em-

ployees to organize. This, he said, was especially true of industries located in the small towns and of new industries. He related several cases of injustice on the part of employers, one being an electric railroad which, after a strike over the discharge of a workman which cost the counties through which the road ran over $48,000, reinstated the discharged man because, on investigation, it was found that his discharge had been unjust. He commended the scheme explained by Mr. Adams and considered that the provision that the board of inquiry should be selected afresh for each case was especially wise. He referred to the fact that the majority of labor troubles were in trades which are newly organized.

Mr. John Barnes was then introduced. He dissented from the opinion expressed by Mr. Mosley that piece work is more common here than in England, nor did he agree with Mr. Mosley in his estimate of the greater extent to which workmen here ran several machines as compared with England. He approved of Mr. Adams' plan and, as a member of an English commission, had reported in favor of a somewhat similar plan. He considered that in the past strikes were necessary and on the whole have served a useful purpose, but that, with both capital and labor organized, there is a probability that better methods will prevail.

Professor J. R. Conners then read a paper on the Restriction of Production. The paper was much more general than its title indicated. He considered that in a broad sense all regulations which are forced upon employers by labor unions are in the nature of restrictions of the employers' freedom of action. He considered high wages and a large output the two great objects of industry.

The next address was by Mr. F. A. Halsey on the Premium Plan. The address contained little that is not already familiar to our readers, with the exception that at the end extracts from numerous letters, about one-half of which were from Great Britain, were read, which letters gave in figures the increases in wages which the employees of the establishments were earning in consequence of the adoption of the plan. He was followed by Mr. James O'Connell, president of the International Association of Machinists, who objected to this and all similar schemes as intended to get from the workman an increase of output without, in the end, increasing his pay. He considered that the effect of all of them was to make pacemakers of the best men and to pit them against the weaker ones. He referred to a case in which a premium had been offered for saving time with a penalty attached for loss of time, the result of which was that in the course of time the men found themselves in debt to their employers by a large amount. He considered the portion of the gain which was due to the workman's efforts, but which the employer appropriated, as in the nature of a fine exacted of the workman for his increased efforts, and believed that encouragement in the form of increased pay to be all that is needed to secure increased output. He declared that the unions did not restrict output nor interfere with the rights of capital.

Following this came an earnest address by Mr. Gompers, which was too long for any satisfactory abstract here. He considered that there is an over-anticipation of what the Civic Federation can do. He considered the idea of personal discussion of differences of great importance; that while such discussion tended to bring men closer together the tendency of long-range discussion through correspondence was to cause them to drift further apart. He explained the organized-labor view of many things which seem strange to many. He referred to the great subdivision of labor as responsible for the position of the unions in the matter of apprenticeship, as, through it, the opportunity for apprenticeship is gone. Boys now learn but an infinitesimal part of a trade and are then used to force down the wages of men.

Mr. Gompers was followed by Mr. White, of the Garment Workers' Union, who read one of the most thoughtful papers of the convention. He devoted his attention especially to the question of labor-saving machinery and, while considering its efforts to be beneficial to the workingmen, pointed out conditions under which it was otherwise.

Professor George Gunton then read a paper on the Philosophy of the Shorter Work Day. He pointed out especially the fact that by reason of economic changes the problem now is to develop the workman's power as a consumer rather than as a producer. While his address was in favor of the shorter day, he disapproved of the eight-hour bill now before Congress. This subject was continued by Mr. A. F. Weber, chief statistician of the New York Department of Labor, who gave an extended historical sketch of the movement for shorter hours from early times and in various countries.

Passing over some papers of less direct interest to our readers, we may note one by F. N. Underwood, president of the Erie Railroad, on Arbitration. He considered the chief weakness of arbitration to lie in the tendency of the unions to select as their representative on an arbitration board one who is in sympathy with them, and even one of their own number, whose object is to get what the men ask for. He considered it essential that the entire board be composed of competent and disinterested men.

The secretary of the Federation, Mr. Easley, then gave the results of an inquiry made by mail of large employers regarding the feasibility of reducing hours gradually, the workmen agreeing on their part to abandon all restriction of output. Of 920 answers to this question, 607 had replied that they regarded such an arrangement as feasible. Mr. Easley stated further that the idea of this inquiry had been embodied in several agreements between employers and their employees.

The last session of the meeting had been appropriated to a discussion of the subject of Trade Agreements, and it proved to be easily the first in interest and importance. The discussion really took the form of the relation of the experiences of the various associations of employers in dealing with the unions of their employees. Several brief papers relating to these experiences were read, the authors being Mr. Griscoll, commissioner of the American Newspaper Publishers' Association; Mr. Mather, of the association of the dock proprietors of the Great Lakes; Mr. Kief, president of the Longshoremen's Union, with which Mr. Mather's association has to deal; Mr. F. T. Towne, president of the American Foundrymen's Association; Mr. Garland, ex-president of the Amalgamated Association of Iron and Steel Workers, and Mr. A. B. Smith, of the Lithographers (employers) Association. The experience of all these men was remarkable in the unanimity of its testimony regarding the successful working of joint agreements between associations of employers and employees. The representatives of the unions related with obvious pride the faithfulness with which these agreements had been observed. Mr. Kief especially referring to cases in which his organization had made disadvantageous agreements, but had then "taken its medicine" and lived up to them. In closing the conference Senator Hanna referred to the manner in which, by unanimous vote of the special committee and subsequently of the entire convention, the bituminous coal miners' union last summer had disregarded the appeals of their brother anthracite miners and had decided to abide by their agreement with their employers' organization, and he paid an eloquent tribute to this evidence of the miners' sense of the sacredness of an obligation, which, he believed, settled the question of the practicability of such agreements. This session alone was sufficient to justify the entire conference. No one could listen to the repeated experiences regarding these agreements without the conviction that real progress is being made in the solution of the vexed problems of the relations of capital and labor, nor can the experiences related act otherwise than to give a powerful impetus to the movement for the organization of employers.

The world seems to be getting smaller every day. Now they are arranging for a through train service from Paris to Pekin by way of St. Petersburg and Siberia. The trip will be made in eighteen or nineteen days, while by the Suez Canal or by the Atlantic and Vancouver it now takes thiry-two to thirty-three days.

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A Hero and an Engineer.

It was the privilege of the writer to listen a few days ago to Rear Admiral Geo. W. Melville while he "talked" (he denied that it was a lecture) to the Engineering Society of Columbia College on his Arctic experiences, especially with the "Jeanette" expedition. No one can listen to such a talk without being deeply impressed with the fact that in Geo. W. Melville the engineering profession can claim to have a man who, entirely aside from his engineering ability, is one in whom any profession might well take unbounded pride. His talk was intended merely to give his hearers an idea of the rigors of an Arctic winter (and for that matter of an Arctic summer as well), but all through it, and, as it were, in spite of himself, there shone out the high-minded and noble hero, the man who in the face of the most appalling difficulties and excruciating suffering, that seemed to have no other possible ending than a cruel death, kept on and on, not only keeping courage himself, but inspiring others, and finally, when all his companions except those in his own frail boat and under his own immediate care and guidance, had perished, the superhuman persistence with which he continued to search for De Long and his party, from whom he had been separated, forms the most remarkable tale of heroism ever related. After having faced death in a thousand forms, endured the pangs of starvation and the agony of water famine, after having worked his way over ice floes with boats, food and other necessaries, most of the party bare-footed and badly frost-bitten, himself as well as many of his companions a mass of sores from knees to feet and from neck to forehead—without a finger nail—all the result of repeated freezing of the flesh, most men would have felt justified in seeking home and relief for themselves and the world would have justified their doing it. But Melville thought that De Long and his companions might still be alive and might be in need of succor, and he seems never to have given a thought to any other course than to keep up the search for them until finally he found them—everyone dead of cold and deprivation—buried them and suitably marked what he then thought would be their last resting place.

The story has been told before, but it cannot be told too often. We do not believe that any instance of bravery or of self-sacrifice performed during the excitement and stimulus of battle is comparable with it. The story marks, we believe, the extreme hight to which man's devotion to duty, his heroism, his willingness to sacrifice himself for others, have risen.

Rear Admiral Melville deserves all the honors that have been heaped upon him. Compared with the sinecure seekers and dollar hunters that so often and so much occupy the stage, he makes them utterly contemptible, and along with it all is his splendid humanity, his inability to forget a friend and his determination that every one who renders a valuable service in the Department of the Navy over which he presides shall receive full and complete credit. Is it any wonder that Geo. W. Melville commands the unflagging fealty and undying devotion of every man in the engineering department of the navy? Or can anyone estimate how much of the splendid attainments of our new navy is due to his magnificent personality?

Outlook for American Machinery in Germany, Austria-Hungary and Italy.

[*By our Special Correspondent.*]

I have very little to say about Germany and Austria-Hungary. In these countries the industrial depression is general, and nobody knows when a change for the better will set in. I have seen many prominent machinery merchants in the principal cities of Germany and Austria-Hungary, but have met none who did not complain. The great engineering works are, as a rule, short of orders and dismissals of large numbers of workmen are of daily occurrence. There are of course some exceptions, but on the whole the outlook for the American machinery trade in Germany and Austria-Hungary is dark. Most of the machine-tool dealers have large stocks, and prices are as low as they have never been before.

In Austria-Hungary the depression is still more felt than in Germany. Besides, the use of foreign machinery is generally discouraged by the government, and all establishments under government control, or receiving government subsidies, or expecting governmental favors, are practically compelled to favor Austrian machinery and material. There is now a law in force in Austria according to which a government license is required for every new establishment. If, for instance, a company has been formed for the purpose of manufacturing boots and shoes, the government, before giving the license will ask: "What do you propose to do? Do you intend installing Austrian made or foreign machinery?" If the latter is the case, you may be assured that the company can wait a good time before it gets the required license.

A well-known machine-tool dealer in Vienna told me that he had for years supplied one of the Imperial arsenals with special machines made in the States. The director of the arsenal had always placed the order without any interference on the part of the ministry. The last order, however, was cancelled by the Vienna authorities, though the machines had already been ordered from the United States.

The business in American machines and tools in Germany and Austria-Hungary

is of course not entirely at a standstill, though the imports have fallen off considerably. It would be foolish to neglect these markets, for there will and must be a revival some day. I am of the opinion that we should especially cultivate the Hungarian market a little more. There is no hostility to American machinery; the chief obstacle there is the ignorance of the people regarding machine utility, economy and the working methods of the different devices. They will not buy upon the strength of printed descriptions alone. Sample machines, put in operation, and explained by experts, followed by the appointment of local agents, constitute the most effective method of introduction.

The Italian market seems to be a little better. I have just returned from the Island of Sicily, where I have spent nearly two weeks. I visited last week the "Esposizione Agricola" now being held in Palermo. Some space is devoted to machinery, and I am sorry to say that I discovered very little American. Only three American firms were represented with a few small exhibits—the Enterprise Manufacturing Company, of Philadelphia; Buffalo Pitts Company, of Buffalo, and the McCormick Harvesting Company, of Chicago. At least 90 per cent. of the machinery exhibited is of German origin; there is also some Hungarian and Swedish machinery (dairy and agricultural). Quite a number of local manufacturers were also represented. Palermo has a few engineering works, which seem to do a fairly good business. The leading establishments of this kind are: Fonderia Oretea, Francesco Panzera, and Girolamo Randazzo. They make steam engines, boilers, separators, and do general repair work.

The machines chiefly in demand on the Island of Sicily are those required for the sulphur industry. There are some 650 sulphur mines in the country, of which about 400 are being worked. Nearly 45,000 hands depend upon this industry. Of the 400 working mines, only 40 use modern machinery.

The following list represents the principal requirements of Sicily: Steam and hand pumps for all kinds of agricultural and industrial purposes, general mining machinery and mining tools, light railway material, irrigation machinery, windmills, hydraulic machinery, wood-working machinery, drills, air compressors, gas motors, electric machines, turbines, portable engines; all kinds of mill supplies, especially lubricating oil; belting and packing, steam and water fittings, pipes and tubes; simpler machine tools to some extent; small tools for carpenters, blacksmiths and the like trades; oil and wine presses, dairy machinery, iron and steel in bars and rods, agricultural machines and implements; powder, stone-cutting and stone-working machinery.

The Italian machine-tool business is concentrated in Milan and Turin. In Milan there are about twenty firms handling American, German, English, Italian and other makes. The best known among these firms are: Carlo Naef, 31 Via Alessandro Manzoni; Carlo Greuter, 1 Via Filodrammatici; Stüssi & Zweifel, 8 Via Dante; Adler & Eisenschitz, 28 Piazza Umberto; John M. Sumner & Co., 44 Foro Bonaparte; De Fries & Co., 36 Via Principe Umberto; Orsini & Moretti, 27 Via Principe Umberto; Della Valle & Tosi, 15 Via Parini; G. Arrigoni & Co., 8 Via Tivoli; Giuseppe Conti, Corso Umberto I; Tecnurgica Lombarda, 8-10 Via Principe Umberto; White, Child & Beney, 36 Via Montebello; Barovero & Co., 20 Via S. Spirito.

The following firms of Milan are especially interested in mill supplies, such as steam and water fittings, belting, packing, lubricating materials, etc.: Amato Jalla Tron & Co., Via XX Settembre 16; American Engineering Co., Via Principe Amedeo 12; Michele Ansaldi & Co., Via Cuneo; Lavini & Rampone, Piazza Solferino; Carlo Meyer, Corso S. Martino 2; Alberto Baer, Corso Re Umberto 17; Gaensler, Bedarida & Co., Barriera di Lanzo 312; Officine Nazionale di Savigliano, Via XX Settembre 40.

The demand for machine tools in Northern Italy, and especially in Lombardy, Piedmont and Liguria, is not a strong one at present, but orders are coming in. The engineering industry in this section of Italy is doing pretty well. In spite of the fact that American tools are recognized in Italy as the best in the world, yet German machines are imported in large quantities. It is a pity that our manufacturers, when busy at home, neglect their foreign business, thus strengthening their own competitors. I have seen several letters from well-known American firms, written in such an abrupt and unbusinesslike way, that I cannot blame the Italian importer or consumer if he places his orders in Germany or England, and I think that a little politeness in business letters will not do any harm. I mentioned before in one of my letters from Spain that the Latin races are an extremely polite people, and they should be treated accordingly, and not from a bulldog standpoint.

Italy, with her large imports of machines, tools and appliances used in her steadily growing industries, offers a first-class market for American manufacturers, and we should do all in our power to gain that foothold on the Italian market that our highly developed machinery industry is entitled to. HENRY L. GEISSEL.

Rome, Italy, October, 1902.

An American Society of Mechanical Engineers Metric Committee.

The Council of the American Society of Mechanical Engineers has appointed a committee to summarize and present the arguments for and against the metric system and the bill now before Congress. The committee consists of the following members: James Christie, of Pencoyd, Pa.; Fred J. Miller, of New York, and Geo. M. Bond, of Hartford, Conn.

The Meaning of the Action of the A. S. M. E. on the Metric System.

We have received from Prof. R. H. Thurston the following communication:

I wish to express my appreciation of the editorial published at page 1804, regarding the action of the American Society of Mechanical Engineers on the metric system. The American Society of Mechanical Engineers was organized for the purpose of securing information, mutual acquaintance and education in professional matters. The question of its official interference with legislation, and of its expression of an opinion on even professional matters very promptly came up, as might have been expected, and was as promptly settled. The policy of that society has been, from the beginning, distinctly opposed to any such action, or to the permission of an implication, even, that it would officially declare opinions or endorse or oppose public movements. It leaves its members thus absolutely untrammeled.

It has in some special cases of general importance, as in that of the formation of a committee to report a standard system of engine trial, organized special committees; but the report of that committee brought up the question here discussed and it was settled, as I think, permanently. It was as certainly, I think, settled in the right way. Where such committees are appointed, their reports are printed and placed before the members of the society and are permitted to be taken by each at his own individual estimate of its value. If the report proves valuable, it will perform a good work in bringing practitioners to a common system; if not satisfactory, it drops out of sight. By this course the society, as a whole, is advantaged and no one is forced, even by moral compulsion, to accept a policy or a practice which he finds unsuited to his own purposes. The society never endorses reports, as a society.

As one of the organizers of the society and as responsible in full share for the foundation of its methods and policies, I feel that I can speak positively regarding this point. It would, in my opinion, be a misfortune to depart from so well-established and so wise and safe a policy.

In the present instance, I think it would be peculiarly unfortunate were the society to take action. The movement under consideration is one which is acknowledged to be in the direction of progress. We certainly cannot stand in its way, nor can we indorse radical action. If the system is adopted, as I have no doubt it will be in the end, it must come by voluntary action of those who find it desirable, not by compulsory legislation. In another

generation, if progress in the arts and sciences is not wholly interrupted by industrial strife, the business of the country will be conducted by men made familar by the teachings of the schools of to-day with a knowledge both of the system itself and of its advantages. It may be fairly expected that they will use it and profit by its use.

The appointment of a committee to investigate and report on the subject is an entirely legitimate action on the part of the American Society of Mechanical Engineers. To pronounce a verdict and to promote compulsory adoption or rejection of the system is quite outside its province.

In a recent hearing before the Senate Committee on Education and Labor, J. H. Mull, assistant manager of the shipyards of the Cramp Shipbuilding Company, said that during the Spanish-American War several of the Cramp workmen belonging to the International Association of Machinists went on board the "Alabama" and seriously disarranged her machinery, which, had it not been discovered, would have severely crippled the ship after she got out to sea. The same thing, it was charged, was perpetrated on the "Thomas" also. All the men except one, Mr. Mull said, were Americans. His statement, he said, was fully corroborated by an inspector of the War Department.

The above statement was vehemently denounced by Mr. Samuel Gompers, president of the Federation of Labor. He said that Major Carson, of the "Thomas," had declared the statements without foundation, that had an attempt been made to tamper with the machinery he would have known it. Mr. Gompers said that "the chief merit in the statement" was that there was not scintilla of truth in it. Mr. Gompers stated the matter concisely as follows:

"If any man was guilty of the act charged here yesterday it was the duty of Mr. Cramp as a citizen of our country to make a criminal charge against him and to expose to the world what it implied. The charge has not been outlawed by the statute of limitation, and if the charge has no foundation in fact it simply reacts upon the heads of those who have made the accusation."

The AMERICAN MACHINIST has just celebrated the twenty-fifth anniversary of its existence by issuing a very interesting and very handsome souvenir extra number to celebrate the event. It has become a custom among technical and trade jounals thus to set up milestones along their pathway and the custom is well justified in the case of publications that are representative of the arts and industries for which they speak. No journal can better claim to have aided and fostered the industries and arts with which it is associated than the AMERICAN MACHINIST, which always, and especially of late years, has been a vigorous and brilliant exponent of progressive tool construction, the development of more perfect machinery, and the advocate of what may best be termed American ideas in the mechanical arts. Of all this the memorial number is a worthy and lasting record, of which its editors and publishers may well feel proud.—*Electrical World and Engineer.*

At the regular meeting of the New England Railroad Club, at the Pierce Hall, Boston, on December 9, a paper on "Electrically Driven Shops" was presented by Robert L. Warner, Boston sales manager of the Westinghouse Electric & Manufacturing Company. Mr. Warner's paper was illustrated by a large selection of stereopticon views showing many examples of the application of direct-current and induction motors to the driving of machine-shop tools and other apparatus.

The British journal known as *The Syren and Shipping* has brought out an American edition which is to be published in the Maritime Building, New York. The journal referred to is a very well-known and highly esteemed journal in shipping circles, and its advent into the American field will be watched with interest.

We learn from an authoritative source that our information to the effect that the German Niles Works, in Berlin, had been closed down indefinitely was incorrect and that the works have not been closed.

Personal.

Lieut. Gustav Kaemmerling, who has been on inspection duty at the Fore River works and at New London, has been transferred to the Cavite Navy Yard. It will be remembered that Lieut. Kaemmerling was one of the engineers aboard Admiral Dewey's ship during the Manila battle, and afterwards had charge of the station at Cavite under Admiral Dewey's administration of affairs.

The H. B. Underwood Company, of Philadelphia, write us: "Kindly make a note of the fact that Daniel W. Pedrick is no longer connected or interested in any way with the Pedrick & Ayer Company. His entire time and attention are now given to H. B. Underwood & Co., of which firm he is the senior partner, and he has also been a partner of this firm since its organization, and is turning out portable cylinder boring bars and other portable tools for railway repair shops."

L. E. Rhodes, of the L. E. Rhodes Company, and who has also been superintendent of the Des Jardins Type Justifier Company, 32 Union place, Hartford, Conn., has recently purchased the manufacturing plant of the Des Jardins Company and will run the works in the manufacture of high-grade machinery and tools. Mr. Rhodes was in the employ of the Pratt & Whitney Company for twenty-one years, during a portion of which time he held a position as contractor in the lathe department.

Obituary.

George W. Simmons, master mechanic of the Philadelphia & Reading Company at Pottsville, Pa., was killed by a yard engine, December 12.

Simpson Bolland, whose name is familiar to our readers as an extensive writer and an authority upon foundry matters, was killed on December 10 at Ossining, N. Y., by being run over by a train.

George W. Prescott, one of the founders and the first president of the Union Iron Works, of San Francisco, was found dead in his apartment at the Palace Hotel, San Francisco, December 12. He was a native of Maine and was sixty-five years old.

George H. Crosby, inventor of the Crosby steam gage, died at Albion, Maine, November 22, seventy years old. Mr. Crosby worked as a machinist until the invention of the gage, from which he realized a large fortune and had a magnificent residence in Albion.

George W. Van Tine, general superintendent of the Singer Manufacturing Company's foundry department at Elizabethport, N. J., was found dead in his bed on December 12. Mr. Van Tine was sixty-six years old, and had been with the company about twenty-five years. He was the inventor of the Van Tine molding machine.

Commercial Review.

NEW YORK, Monday, December 15.

Considerable speculation is being indulged in nowadays as to whether or not next year will witness a continuance or an abatement of the great industrial prosperity which the country has enjoyed during the past year. We observe that wherever the subject is discussed, optimistic views are generally expressed.

So far as the iron and steel industry in all its branches is concerned, we note this to be particularly so. Although we have questioned many in the matter, we have yet to hear of any pessimistic utterance being made which did not have some qualification to it.

So far as the machinery market is concerned, the prospects are of the brightest. Recently we stated that many manufacturers of machine tools base their belief in a good trade for next year, on the fact that they have received many inquiries which denote the placing of some excellent orders later on.

But the outlook for a prosperous year in the machine-tool industry is rendered even more encouraging by some recent developments. To begin with, reports come in frequently nowadays of many

concerns intending utilizing some of the profits of the present year in the displacement of machine tools of antiquated design for those into which all modern improvements enter. One manufacturer informs us that his company has nearly $100,000 worth of business in sight of this character alone.

The railroads are also relied upon to make some extensive purchases of machine tools next year. We have recently noted how several railroads have already been heard from in this direction, but from what we hear, they represent but a small portion of those which have yet to come into the market. The immense traffic handled by the railroads recently, and the consequent increased motor equipment it has entailed has made some very heavy demands on their repair shops, with the result that plans for equipping them with new machine tools have already been perfected, or will be later on, thus insuring some good orders from this source.

Then there are many new shops in course of construction, which will necessitate the purchase of many machine tools. In our last issue we called attention to two shops alone which are being built and which will be purchasers to the extent of about $1,500,000. Of smaller shops now being erected, which will be in the market next year for machine tools, there are numerous. There are other reasons, doubtless, which impel machine-tool manufacturers to believe that the new year has some good in store for them, but those we have enumerated are the most important.

We notice that wherever there is a tendency to believe that our present industrial prosperity will suffer some recession next year, it hinges on the outlook for the raw material market. There are many, for example, who do not think that the present high price of pig iron will continue, and that with the drop in prices they expect, will come depression in all finished lines. This view has been accentuated by the recent reductions made in tin plates, sheets, and other light products, which we have already pointed out was caused by increased producing capacity, rather than by decreased consumption; and more recently by the decline which has taken place in Middlesbro No. 3 iron, which can now be imported at about $1.50 less per ton than a few weeks ago.

But against these supposed bearish developments can be placed the fact that all of the Northern and Southern furnaces have already sold nearly all of the iron they can produce for the first six months of next year, and at prices on a parity with those which now prevail. Then the steel-plate mills cannot come any way near filling the orders they receive, with the result that fancy premiums for early delivery are cheerfully paid, and orders extending into 1904 are being placed. In structural material, the situation is equally as good, with orders for 1904 being booked also. Then the rail mills report that orders received by them already, and those which they know to be in prospect, indicate that they will have enough business to keep them busy until October at the earliest. Last, but not least, the United States Steel Corporation announces that it has unfilled orders on its books to the extent of 5,280,000 tons, the largest in its history. So far as trade conditions in general are concerned, commercial agencies report them to be excellent.

President J. W. Duntley, of the Chicago Pneumatic Tool Company, arrived from Europe during the week, and left for Chicago on Saturday. From a business standpoint Mr. Duntley's trip was remarkably successful. Apart from completing plans for the erection of a new plant in Scotland, which was the main reason for his trip, Mr. Duntley brought back 2,460 orders for his company.

In speaking to the writer concerning his trip, Mr. Duntley said:

"What pleased me most on my trip was the remarkable success our London office is making relative to the extension of our business abroad. A few months ago it did an average business of about 250 orders a month. Later on this jumped to 300, and during November 657 orders were taken. To-day (Saturday) I received a cable from our London office saying that during the first ten days of December it took some 300 orders. I come home bringing 2,460 orders with me, and these must be executed within sixty days, so I am compelled to get back to Chicago as quickly as possible, in order to see that this is done.

"Some time ago we sent four men to Europe to introduce our tools, and their efforts are meeting with considerable success, particularly in shipyards. While I was in Europe, the men were devoting their attention to the shipyards of Germany. They visited seven yards, and succeeded in having our tools installed in all of them. We have been requested to send them to France, Spain and Italy, and intend to do so.

"At the present time our business has assumed such proportions that our orders are beyond our producing capacity. Despite the fact that we have two factories abroad, they fall far short of being able to meet the demands made on them. In consequence, while abroad, I made arrangements for the building of a new plant at Fraserburgh, in Aberdeenshire, Scotland. This plant will cost about $175,000, and the necessary machinery will be purchased in this country. The construction will be pushed with all possible haste. I also arranged, while abroad, for a German factory to make our tools on contract."

When asked how he found the machinery trade abroad, Mr. Duntley said that with the exception of Germany it was better than it had been.

The Philadelphia Pneumatic Tool Company has just completed the equipment of Kaiser Wilhelm's new navy yard at Kiel, Germany, with an outfit of Keller pneumatic tools. This is the latest phase of the American commercial invasion of Europe. Looking in the opposite direction, this company reports an increasing trade on the Pacific coast. Mr. O. A. Berger, the representative of the Philadelphia company in San Francisco, has just visited the home office, bringing with him some large orders from the various shipyards, steel works, etc., on the Pacific coast.

During the week the Board of Public Improvements, of St. Louis, Mo., opened bids for the construction of electric-lighting plants for the city hall, poorhouse and insane asylum, and for electric elevators in the new city hall. The lowest bids were as follows: Engine for city hall, Chase Engine & Manufacturing Company, $13,453; dynamos, Westinghouse Electric Company, $12,750; conduits, Abbott-Gamble Construction Company, $4,900; engines for insane asylum, Brownell & Co., $3,330.40; dynamos, Westinghouse Company, $5,800; pole lines, Acme Electric Supply Company, $1,263.71; three elevators for city hall, Otis Elevator Company, $11,716.

The Cleveland Cliffs Iron Company is about to install an electric power distribution system for operating mixers and blowers in its Gladstone (Mich.) plant. It has recently purchased from the Westinghouse Electric & Manufacturing Company two 75-kilowatt direct-current generators and eight 10 horse-power direct-current motors. The Pioneer Iron Works of Marquette, Mich., owned by the Cleveland Cliffs Company, will also be equipped with electrical apparatus, which will be used for the operation of mixers and blowers, as in the Gladstone plant. Apparatus recently purchased from the Westinghouse Electric & Manufacturing Company for the Marquette plant includes ten 10 horse-power direct-current motors and two 150-kilowatt engine-type generators to be direct connected to two Westinghouse compound condensing engines. The company has also ordered a Baldwin-Westinghouse electric locomotive to be used for shifting cars in its yards.

The Ward-Corby Company, who operate bakeries in Pittsburgh, have under way new bakeries in Chicago and Providence, which plants are being supplied each with 150 horse-power boilers furnished by the Pittsburgh Gage & Supply Company, of Pittsburgh. This concern is also supplying the Pittsburgh Tool & Drop Forge Company, Cheswick, Pa., with one 150 horse-power water-tube boiler, as well as the Windsor Hotel, Wheeling, W. Va., with a 65 horse-power water-tube boiler.

The Q & C Company, of Chicago, make shipment this week from their factory at Chicago Heights, of one of their largest special metal-sawing machines to the United States Government to be used at the Cavite Navy Yard at Manila.

Miner & Peck Manufacturing Company, proprietors of the Peck Drop Press Works, New Haven, Conn., state that the demand for drop presses is not only holding up, but that it is steadily increasing; the number of orders received during November being greater by 25 per cent. than any month the past four years, and they are now considerably behind in their deliveries. Mr. Peck also stated the foreign business in their line seemed to be picking up, and they are doing quite a good business across the water, especially in England and Australia.

The American Blower Company, of Detroit, Mich., report a number of large orders on their books, among which they mention contracts for heating apparatus for the Iron City Sanitary Manufacturing Company, Zelienople, Pa.; Enterprise Manufacturing Company, Columbiana, Ohio; B. F. Lee Company, Braddock, Pa.; Monongahela (Pa.) Forge & Furnace Company; New York Glucose Company, Edgewater, N. J., and the Michigan Malleable Iron Company, Detroit; mechanical draft apparatus for the International Paper Company's Corinth (N. Y.) mill, Geo. H. Hammond Company, Chicago; Lehigh Valley Coal Company, New York; Princeton (N. J.) University, and the Binghamton (N. Y.) Electric Light & Power Company.

The increase in the demand for the adjustable self-opening screw-cutting die heads and automatic collapsing taps of the Geometric Drill Company, New Haven, Conn., the past six months has been so great that they have been compelled to take another building next to their present works in Westville, and are now fitting it up with machinery; this will enable them to increase their already large output about 75 per cent.

The following from *Dun's Review* on the condition of trade in American machinery in South Africa fully corroborates what we have set forth from time to time:

"A single American mining machinery firm having a large and well-appointed branch in Great Britain reports that it has machinery already made and ordered for South African account aggregating over $1,000,000 in value, and awaiting shipment. The other firms already established in this market are in similar position, and, as they have their representatives constantly on the ground, nothing can be published here that will be of any service to them. The process of improving and extending existing plants and of establishing and equipping new ones is, however, going on with such rapidity that there will very probably be opportunities for many manufacturers not at present engaging largely in the South African trade to secure a foothold there if they go about it in the right way.

"In agricultural machinery American manufacturers are making remarkable progress in South Africa, although a great deal still remains to be accomplished. The greater part of the plows ordered in connection with the re-stocking of the Boer farms appear to have come from the United States, while the orders for cultivators were placed in Great Britain. Thus far comparatively little large machinery, such as reapers and threshing machines, has been imported into South Africa. The growth of American trade in other lines has been very remarkable. For the ten months ending with last October the exports of American farm implements to British Africa aggregated $481,291, as compared with $195,124 for the corresponding portion of the previous year, and $182,575 for the entire continent for the first ten months of 1900. The exports to South Africa for the present year thus far exceed the total sent to the entire continent at any previous period of equal length, including the year 1899, when exports from this country were abnormally large. Reports state that the demand for hand implements has also been very brisk, a single factory in the West having worked nights for many weeks on South African orders. This market is at all times a good one for windmills and irrigation machinery, and if the elaborate irrigation plans recently prepared by a government expert are carried out there will be a large increase in the demand for this class of equipment.

"In general machinery, especially in the wood-working and metal-working trades, there is likely eventually to be a far larger market in South Africa than at present. The cost of transportation from America and Europe will favor the establishment of more factories for the manufacture of furniture, carriages and other lines already made to a considerable extent in these colonies, while there is an increasing disposition on the part of railway and other authorities to establish local shops for doing much engineering work at present sent abroad. There will be large demands for cranes and other dock machinery as the extensive plans for port improvements are advanced."

CHICAGO MACHINERY MARKET.

The representative of a prominent electrical machinery maker remarks that it is more difficult to give a commercial line of the state of trade in motors and generators than almost any other industry. One month the activity is felt by one maker, the next month by another and so on. The buying of electrical machinery proceeds on a different basis from that pursued in the purchase of a machine tool. The buyers know something about the operation of the latter, for it is tangible. About the motor or the generator in 75 per cent. of the instances he knows absolutely nothing concerning the construction, and is therefore dependent upon reputation, the advice of some friend who has used similar machinery, or some other extraneous consideration. This helplessness on the part of the average buyer is seen even in the case of the large buyer who employs the services of an electrical engineer to aid him in making choice. Ten to one the engineer will throw out from consideration the machinery of any maker with whom he is unfamiliar. Hence more than in almost any other line reputations and familiarity have to be sedulously cultivated.

Demand for electrical machinery in the West is this month variously interpreted and described. But reports seem to agree in this, that a quite large amount of inquiry is in the market, some of it of a preliminary character and some of it, as where manufacturing buildings are in actual process of construction, to be followed by early purchases. On the whole, the aggregate business is of a satisfactory character, though the impression exists in a majority of offices that business is rather quiet. Last year there was a good December inquiry, followed by active January and February buying. The same development is looked for this year.

Armour & Co. have bought a 1,500 Westinghouse generator for installation in their Chicago packing-house plant. This is one of the largest, if not the largest, transactions of the past month. But a fair amount of smaller business has been closed. The C & C Electric Company reports an excellent trade in November, with December starting in at about the same good pace. The Bullock Electric Manufacturing Company is turning out more product, and hence can make better deliveries, but the aggregate of their new business, it is said, is not decreasing. The Chicago Street Railway Company is still buying in a desultory fashion merely to piece out their urgent necessities, but plans for extensive improvement await favorable franchise legislation.

Among orders recently taken by the Crocker-Wheeler Company are the following: Bucyrus Company, South Milwaukee, Wis., 150-kilowatt belted generator; National Malleable Casting Company, 385 horse-power motors; Pettibone, Milliken & Co., Chicago, one 600-kilowatt generator, direct connected, and motors of 960 horse-power; Jenks Shipbuilding Company, Port Huron, Mich., one belted and three crane motors; G. H. Hammond Company, Chicago, one 400-kilowatt generator; J. W. Reedy Elevator Manufacturing Company, 120 horse-power motors, and Lake Shore shops, Collinwood, 165 horse-power motors.

Quotations.

NEW YORK, Monday, December 15.

New York prices for Northern and Southern irons for the first half of 1903 are as follows:

Northern:

No. 1 X	$23 25 @ $24 75
No. 2 X	22 00 @ 22 75
No. 2 plain	21 00 @ 21 75

Southern:

No. 1 Foundry	23 25	@	23 50
No. 2 Foundry	22 25	@	22 50
No. 3 Foundry	21 50	@	22 00
No. 4 Foundry	20 50	@	21 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.95c. upward in carload lots. Smaller quantities from store, 2.15 @ 2.30c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—2.90c. from store for base sizes.

Copper—Lake Superior ingot, 11½ @ 11⅝c.; electrolytic and casting, 11⅜ @ 11½c.

Pig Tin—In 5- and 10-ton lots, f. o. b. New York, 25¾ @ 25⅞c.

Pig Lead—4.10 @ 4.12½c., in 50-ton lots.

Spelter—4.95 @ 5.00c.

Antimony—Cookson's, 8½ @ 8⅝c.; Hallett's, 7⅛ @ 7½c.; other brands, 6¾ @ 7c.

Lard Oil—Prime City, 88 @ 90c., according to brand and quantity, ranging from one barrel up to large lots.

Manufacturers.

The Standard Oil Company will build a boiler and machine works at Salt Lick, Ky.

The foundry and machine establishment of Blum Bros., Concord, N. C., is to be enlarged.

A two-story factory, 127x53½ feet, is to be built for the Burlington (N. J.) Sanitary Works.

The show case and store fixture factory of McCassy Bros., Cincinnati, O., has been burned.

The Michigan Bolt & Nut Works, Detroit, Mich., are preparing to build an addition to their plant.

A pail shop and other buildings of Brown's Lumber Company, Whitefield, N. H., have been burned.

The Gregor Manufacturing Company has taken out a permit for a foundry, 70x86 feet, at Camden, N. J.

The Standard Steel Car Company has awarded contracts for the enlargement of its plant at Butler, Pa.

An additional three-story, 140x72-foot building will be built at the Standard Steel Works, Burnham, Pa.

W. J. Fell, Salt Lick, Ky., is about to erect a new factory to be used for making bent wood articles and kegs.

The Fergus Casket Works, Fergus Falls, Minn., will build a new factory, in which machinery will be placed.

The Bullard Machine Tool Company, Bridgeport, Conn., is erecting an additional brick factory building, 40x112 feet.

La Crosse, Wis., is to have a new pearl button factory to be operated by the La Crosse Pearl Button Company.

Plans are being made for an addition to the paint plant at Gibbsboro, N. J., of John Lucas & Co., Philadelphia, Pa.

The Waters-Pierce Oil Company, St. Louis, Mo., has purchased adjoining land, giving it more room for factory purposes.

Francis Willey & Co., of Bradford, England, are about to build a $200,000 textile mill at Crossleyville, South Barre, Mass.

The L. Wolff Manufacturing Company, Chicago, plumbers' supplies, has let the contracts for a four-story addition, 313x123 feet.

It is stated in Westwood, N. J., that lumber is on the ground for an extension to the American cigar box factory at the Manor.

A group of buildings for the manufacture of bricks will be erected in Perkiomen, Pa., for the Montello Brick Company, Reading, Pa.

Fire in the roll covering, etc., establishment of Wm. R. West, New Bedford, Mass., has ruined or badly damaged the machinery.

Col. Tracy W. Pratt, president of the West Huntsville (Ala.) Cotton Mills, is arranging for the establishment of another large cotton mill.

The Southside Manufacturing Company, fruit baskets, crates, butter dishes, etc., Petersburg, Va., will build a factory in Blandford.

J. M. Frink, manager of the Washington Iron Works Company, Seattle, has taken out a permit for the pile foundation of a new building.

The Chas. Wege Marble & Tile Company, Columbus, O., is erecting a new factory building which will be equipped with machinery for finishing marble work.

The Lehigh Valley Railroad at its New York office is planning for new shops at Sayre, Pa. It is rumored that the machine shop will be 750x300 feet.

The Shamokin (Pa.) Silk Mills have increased their stock from $70,000 to $200,000. The plant will be enlarged, and 200 more persons given employment.

A manufacturing building at Cleveland, O., occupied by Bardons & Oliver, turret machinery manufacturers, and the Likly & Rockett Trunk Company, has been burned.

We understand that the Washington, Baltimore & Annapolis Electric Railroad Company is furthering plans which will involve the construction of a large power plant.

Preliminary plans are being prepared for a three-story addition to the brew house and a two-story addition to the ice plant of the brewery of William Heimgartner, Philadelphia.

The directors of the James Robertson Manufacturing Company, sheet lead, lead pipe and plumbing supplies, Baltimore, Md., will in January consider the advisability of building an addition.

It is proposed to erect at Annapolis, Md., machine shops and car sheds for the Baltimore, Washington & Annapolis Railway Company, and plans have been made for a 180x60-foot building.

A Chicago syndicate headed by Thos. B. Lyons, has purchased 850,000 acres of cypress land near New Orleans. The Louisiana Cypress Lumber Company will be incorporated and a large plant built.

A sugar factory is about to be built in the region of the Tawases, Mich. Chas. B. Warren, of Detroit, who is thought to be an attorney for the Havemeyer interests, has subscribed for a large block of stock.

The Carrom-Archarena Company, of Ludington, Mich., is building an addition, 30x132 feet, two stories, to its plant, and will use the extension for the manufacture of a new combination billiard and parlor table.

F. E. Myers & Bro., force and lift pumps, hay tools, etc., Ashland, O., have just closed a contract for an addition to their storage and shipping warehouse, of over 100 feet in length, four stories high, making, with their present brick warehouse, a structure 350x50 feet, four stories.

Plans are being made for a 90x250-foot foundry, to contain electric cranes and modern improvements, for the Sheffield Car Company, manufacturer of light cars, Three Rivers, Mich. This concern is said to be connected with Fairbanks, Morse & Co., of Chicago, Detroit, etc.

John C. MacInnes, of Worcester, Mass.; Peter Murray, of Springueld, and Frank Knowles, of the Crompton & Knowles Loom Works, of Worcester, and other men interested in woolens have been in North Adams in conference with manufacturers there regarding a new mill.

Warren E. Willis, 318 Frick Building, Pittsburg, Pa., has under construction plans for the plant of the "Manufacturing Company of Pittsburg" and will fit the same up in all departments; hence is interested in building material, hardware, foundry appliances, general machinery, etc.

The Provident Security & Banking Company, incorporated in Boston, Mass., and represented in Denver, Colo., by R. A. Gurley, of the Gurley Investment Company, is arranging for an irrigation system in San Miguel and Montrose Counties, Colo., with beet sugar and canning factories.

The Bittner Brick Company has been organized and it will erect a brickmaking plant near Volant, Lawrence County, Pa. A. S. Good, of New Castle, Pa., is president; D. V. Murdock, of Fredericksburg, O., vice-president; Frank J. Peffer, Pittsburgh, secretary; E. B. Bittner, of New Castle, treasurer.

It is stated at Toledo, O., that a 65x150-foot building, which will be duplicated in six months, is to be erected at Birmingham for the Toledo Castings Company. The new concern is under direction of President P. G. Leach, of the Detroit railway supply house of Leach & Co., which will manufacture supplies through it.

A building on Canal street, Chicago, occupied in great part by the Marshall & Huschart Machinery Company, has been destroyed and an adjoining one damaged by fire. The loss on building and contents is estimated in a press report at $100,000, but we have not learned definitely at this writing how badly the company named suffered.

The Morris Sherman Manufacturing Company, builder of boilers, etc., Chattanooga, Tenn., is planning a machine shop and warehouse addition. The concern has been in operation only since August 15, but is receiving orders from Canada and Mexico, as well as this country. It is doing quite some work for the U. S. Leather Company.

The Withington Perfection Spring Lock Fence Company has been organized, with a capital stock of $100,000. Officers have been elected as follows: President, S. S. Withington, Adrian, Mich.; vice-president, W. W. Cook, Clayton; secretary, W. H. Shearson, Adrian, and treasurer, N. B. Hayes, Adrian. The company will build a factory at Adrian in the spring.

The National Loom & Wire Company, of Enfield (Conn.?) has filed articles of incorporation. It has a capital stock of $100,000, and it will manufacture looms, machinery and wire. Its specialty will be a patented improvement in wire-weaving looms. The incorporators are Oscar S. Greenleaf, Peter Murray and Elihu H. Custer, of Springfield, Mass., and John N. Brown, of Holyoke, Mass.

The U. S. Steel Corporation, which is adding three new furnaces in the Pittsburgh district, has in view nine more—three, it is thought, for the Pittsburgh, four for the Youngstown and two for the Chicago districts. These would bring the pig iron production of the company, which is now buying

2,000,000 tons a year of the merchant furnacemen, about up to its steel-making requirements, only the latter lines of work will be increasing meantime.

The Fort Pitt Bridge Works have received an order from Hyde Brothers & Co., Pittsburgh, for the construction of a large plant near Center Station, on the Buffalo, Rochester & Pittsburgh Railroad. There will be twelve single puddling furnaces and four double furnaces. Machinery from a spike plant purchased in Virginia is being removed to the new plant at Center. In addition the works will be supplied with new machinery, much, if not all, of which has been ordered.

It is stated that the Westinghouse Electric & Manufacturing Company, of Pittsburg has decided to open a factory in Ottawa, Ont., for the purpose of cutting and otherwise preparing mica for use in the electrical business. The supply will be procured from the Gatineau and Kingston district. At the start employment will be given to 200 men and girls. At present the company gets a large share of its mica from India. The new factory may focus attention on the enormous Canadian supply.

The Capital Manufacturing company, Des Moines, Ia., is about filing articles of incorporation. The directors will probably be James G. Berryhill, Thomas F. Hurley, Thomas F. Cooke, H. Barna and Ernest W. Brown. It is planned to erect a building equipped with machinery for the manufacture of the Capital gas light mantle, which has been made by Mr. Barna in Des Moines for three years. Recently Mr. Barna secured a large contract from the United States Government. The company has contracts already on hand for several hundred thousand mantles. Frank X. Spitz will represent the company in Denver, where he will establish a branch factory.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Grant. Gears. See upper corner, page 56.

See the Lowe test indicator, page 81.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Who builds the most complete harvesting machine? Answer "Farmer," care AM. M.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Working drawings for special machinery, patent articles, etc. Geo. M. Mayer, M. E., Monadnock, Chicago.

Wanted—One second-hand lathe, 36 or 40 in. swing; state price and condition. Box 329, AMERICAN MACHINIST.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Practical manufacturing expert, designer of special tools, shop systems, etc. Eugene Wilson, AMERICAN MACHINIST.

An experienced engineer will perfect, simplify or improve upon articles of manufacture. Address Box 340, AMERICAN MACHINIST.

Young, active, practical machinist has $2,000 to $3,000 to invest, with services, in established business; best references given and required. Write particulars to Box 343, AMERICAN MACHINIST.

Wanted—Light machine work and special machinery to build to order, special tools, die and punches; a well-equipped water-power plant and first-class workmen. The Bantam Mfg. Co., Bantam, Conn.

Wanted—Additional capital for the purpose of increasing the output of an established automobile manufactory having a number of perfected vehicles now running on the road. Box 314, AMERICAN MACHINIST.

For Sale—An established automobile business, having bona-fide vehicles running on the road; includes well-equipped plant in large city, drawings, patterns, patents and good will. Box 313, AMERICAN MACHINIST.

Wanted—A large contract to build medium or light automatic machinery; we have the plant, the experience, the capital; cam cutting a specialty; we make the best adjustable reamers. Ott. Mergenthaler Company, Baltimore, Md.

Liberal commission to machinery salesmen able to handle, as a side line, machines suitable for use by railroads, machine shops, saw and planing mills and by all manufacturers of wood and metal. Address Box 241, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Bound volumes AMERICAN MACHINIST for sale; 10 volumes (11 years), from Vol. 1, No. 1, to Vol. 11, inclusive; bound in stiff board, sheepskin corners and backs; all in A No. 1 condition; $3 per volume, if sold at once. Address Charles Rose, Jr., 486 Park ave., Worcester, Mass.

For Sale—One 250 light dynamo, all complete; practically new; 20 arc lamps for same; two 8 ft. single transmission wheels; one 8 ft. double transmission wheel; two 5 ft. single transmission wheels, Roebling's make, lined with rubber and leather. Utica Pipe Foundry Co., Utica, N. Y.

A chance to introduce specialties and establish agencies among the mill supply and hardware trade throughout the country; we have one of our own, are incorporated, and our salesmen are constantly visiting the trade; bank and business references. Address The Chase Company, Lancaster, Pa.

A first-class foundry with compressed air plant, established 10 years, doing all kinds of machine casting, desires to combine with manufacturer of special machinery for mutual advantage; building specially designed for this purpose, near completion; reliable parties only need apply. Address Box 330, AM. M.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Machine designer, etc., wants position. Address Box 63, AMERICAN MACHINIST.

Draftsman, mechanical, designer, seeks position. Box 333, AMERICAN MACHINIST.

Mechanical draftsman wishes to change position. Box 331, AMERICAN MACHINIST.

As foreman, by A1, progressive pattern-maker. K. G., care AMERICAN MACHINIST.

Engineer wants position, erecting or installing machinery. Box 327, AM. MACH.

Practical machinist, of wide experience, 12 years in charge, desires situation as foreman. Address Box 332, AMERICAN MACHINIST.

Practical draftsman desires position with firm requiring designing, etc.; New York or vicinity. Box 334, AMERICAN MACHINIST.

First-class mechanical draftsman (electrical experience) desires position; several years' shop practice. Box 323, AM. MACH.

Superintendent or general foreman of machine shop, by practical mechanic; 24 years' experience; 12 years in charge; 38 years of age. Box 335, AMERICAN MACHINIST.

Manager—A technical graduate, 33 years old, with 8 years' practical experience in manufacturing and business management, is open for engagement. Box 326, AM. MACH.

Wanted—Position as manager or superintendent; am well up in boiler, steam engine and foundry practice, cheap production and accurate cost system. Address Box 293, A. M.

Mechanical engineer, expert designer, wishes position with large manufacturing concern, to design special machinery and introduce labor-saving methods. Box 307, AMER. MACHINIST.

Young man, first-class mechanical and civil engineer and draftsman, expert in operating and designing cement plants, desires position with first-class company. Box 342, AM. MACH.

A man with valuable experience in mill design and operation, steel, brass and copper, will correspond with any concern desiring the services of such a man; technical graduate. Address Box 337, AMERICAN MACHINIST.

Wanted—Position by up-to-date foundry foreman; have had charge of shop for past 8 years, on heavy machinery castings, but wish to make a change January 1, 1903. Box 322, AMERICAN MACHINIST.

A thoroughly competent man of experience desires position as superintendent or foreman in machine shop; past 2 years as sup't in electrical line. Address "Superintendent," care AMERICAN MACHINIST.

Position as superintendent, by man, 31 years old, familiar with medium weight machine tools, bicycles and automobiles; 9 years' experience; can furnish good references. Box 320, AMERICAN MACHINIST.

Machinery salesman wants position as representative, salesman or erecting man; New York or vicinity; 10 years' experience in designing and installing; 8 years as business manager; highest references. Address Box 324, AMERICAN MACHINIST.

A good designer, machinist and toolmaker, experienced foreman (foreman at present), with very best references from past and present employers, wants position January 1, to improve; present salary $1,350; age 26. Box 325, AMERICAN MACHINIST.

Mechanical engineer, college graduate, experienced designer of gas engines and gas power plants, general engineering and modern shop management, seeks position as superintendent, chief engineer or head draftsman. Address Box 341, AMERICAN MACHINIST.

Position as manager (or assistant manager large concern); thorough experience in handling office and manufacturing departments; expert in accounting, methods of increasing production and obtaining accurate detail costs; experienced correspondent with legal training; age 32. Box 317, AM. MACH.

A practical superintending engineer, of many years' experience, is open for an engagement; skilled in designing, invention and difficult machine construction; experienced in modern shop practice; capable executive in the organization and handling of men and appliances; highest references given. Address Box 321, AMERICAN MACHINIST.

Help Wanted.

Wanted—Good chemist for small gray iron foundry. Address Box 318, AMER. MACH.

Wanted—A competent man to take charge of our hand screw machine department. Address Box 336, AMERICAN MACHINIST.

Wanted—First-class machinists, in city near Philadelphia; steady work and good pay. The Reeves Engine Co., Trenton, N. J.

Liberal commission to machinery salesmen to handle, as a side line, the Hartford Bench filing machine. Kinsey-Burt Co., 136 Liberty st., New York.

Wanted—Machinists and draftsmen to send postal for free sample tables of lathe gearing and valuable formulas and tests. Box 290, AMERICAN MACHINIST.

We want an experienced man on a profiling machine; state experience, references, age and salary expected. Address "Advance," care AMERICAN MACHINIST.

Machinists—Send 5 cents in stamps for blueprint table of U. S. standard steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—General machinists, to work principally on general job work; good wages and steady employment. Townsend Foundry & Machine Shop, Albany, N. Y.

Wanted—A bright, young, energetic lathe man, to take charge gang of small lathes. Address, giving age, references, salary, "Henderson," care AMERICAN MACHINIST.

Wanted—Positions for experienced men, and men for such positions. Address James Brady (late Brady Mfg. Co.), Room J, 20th Floor, 220 Broadway, New York.

Wanted—Lathe and planer hands for night work on heavy machine tool work; good wages to good men. Apply to The Pond Machine Tool Company, Plainfield, N. J.

Wanted—First-class die sinker on drop forge work; steady employment to the right party; give age, experience and wages expected. Box 328, AMERICAN MACHINIST.

Help Wanted.—Western man as machine shop foreman in manufactory of agricultural machinery; give reference, experience and salary expected. Box 315, AMER. MACHINIST.

Wanted—Ten first-class machinists on small, close work; good wages and steady work to competent and reliable men; no trouble. Apply to The Harris Automatic Press Co., Niles, Ohio.

Wanted—A first-class draftsman, who has had thorough practical experience in designing air-pressure machinery; give proof experience and salary required. Address "Pressure," care AMERICAN MACHINIST.

Swedish-Americans wanted; several first-class locomotive erectors and locomotive boilermakers; apply, stating age, experience and wages expected. Address Vagn-och Maskinfabriks-Aktiebolaget, Falun, Sweden.

A man wanted who thoroughly understands hardening and annealing; state qualifications for other machine shop work, also mentioning age, experience, references and salary. Address "Annealing," care AMERICAN MACHINIST.

Wanted—At once, a first-class draftsman; one accustomed to a general run of machine work and capable of doing his own thinking and designing; a good position to the right man. Address Box 247, AMER. MACHINIST.

Wanted—Experienced designer and draftsman who thoroughly understands compound engines; permanent employment for competent man; state age, experience and salary wanted. "Manufacturer," Drawer 974, Buffalo, N. Y.

We are constantly increasing the scope of our work, and invite application for positions from first-class patternmakers, molders and machinists; we always have vacancies. Address The Westinghouse Machine Company, East Pittsburg, Pa.

Wanted—Foreman; responsible and experienced man to produce light interchangeable work; shop is equipped with new and highest grade tools; just starting to manufacture; good chance for right man. Address Box 291, AMERICAN MACHINIST.

Wanted—Foreman for manufacturing department; expert in the making of light interchangeable parts; excellent opening for right man; state fully experience, age and compensation wanted. Address Comptograph Company, 146 Blackhawk st., Chicago.

Wanted—Detail draftsman on medium heavy machine tool work; only sober, industrious man of family who is looking for permanent position need apply; state past experience, with whom and salary expected; location in Middle West. Address Box 338, AMERICAN MACHINIST.

James Brady, member American Society Mechanical Engineers, former owner of Brady Mfg. Co., consulting engineer and appraiser, particular attention given to economy in manufacture, can furnish good men for heads of departments in the metal-working industry. Room J, 20th floor, 220 Broadway, New York.

A large factory, located in the Middle West, manufacturing a full line of electrical apparatus and instruments, requires the services of a young man with toolroom and drafting-room experience, to design special tools, originate better methods, set premium rates, etc.; state experience, references and salary expected. Address Box 319, AMER. MACHINIST.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

Wanted—Young man to take charge of foundry, as superintendent, near Troy, N. Y.; one having been assistant in a large, up-to-date shop and desiring to better himself, preferred; foundry runs steady, employs about 30 molders; heavy machine work; no jobbing; need not have experience mixing or melting iron, but must be able to handle men smoothly and firmly; one having experience on molding machines preferred; state, in your own handwriting, age, where have been employed and how long, salary expected, married or single and full particulars. Address Box 339, AM. M.

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Bartlett, E. E., Boston, Mass.

Ball Bearings
See Roller Bearings.

Balls, Steel
Federal Mfg. Co., Cleveland, O.

Band Saws
American Machinery Co., Grand Rapids, Mich.

Barrels, Steel
Cleveland Wire Spring Co., Cleveland, O.

Bars, Boring
Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

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Besly & Co., Chas. H., Chicago, Ill.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

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Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia, Pa.

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Schieren & Co., Chas. A., New York.

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Diamond Drill & Mach. Co., Birdsboro, Pa.

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Schieren & Co., Chas. A., New York.
Shultz Belting Co., St. Louis, Mo.

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Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Cincinnati Punch & Shear Co., Cincinnati, O.
National Mchry. Co., Tiffin, O.
Reade Mchry. Co., Cleveland, O.

Bending Machines, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

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Hilles & Jones Co., Wilmington, Del.
Perkins Mach. Co., So. Boston, Mass.
Wickes Bros., New York.

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See Hoists, Hand.

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Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.

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Abendroth & Root Mfg. Co., Newburgh, N. Y.
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Webster & Perks Tool Co., Springfield, O.
Wells Bros. Co., Greenfield, Mass.

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Baird & Co., Henry Carey, Philadelphia, Pa.
Derry-Collard Co., New York.
Henley & Co., N. W., New York.
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Wiley & Sons, John, New York.

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American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Drilling Machines, Horizontal
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
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Detrick & Harvey Mach. Co., Baltimore, Md.
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National Mchry. Co., Tiffin, O.

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National Machy. Co., Tiffin, O.

Castings, Brass and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Steel
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Rahway, N. J.

Catalog Files
Derby Desk Co., New York.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Phoenix Mfg. Co., Hartford, Ct.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven Conn.
Pratt & Whitney Co., Hartford Conn.
Reed Co., F. E., Worcester, Mass

Chains, Driving
Boston Gear Works, Boston, Mass
Federal Mfg. Co., Cleveland, O.
Bridgeport Chain Co., Bridgeport Conn.
Jeffrey Mfg. Co., The, Columbus Ohio.
Link Belt Engr. Co., Phila., Pa.
Morse Chain Co., Trumansburg N. Y.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co. Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven Conn.
Cleveland Twist Drill Co., Cleveland, O.
Cushman Chuck Co., Hartford, Ct.
Goodell-Pratt Co., Greenfield Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y

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Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Son Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Scroll
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Hardinge Bros., Chicago, Ill.
Faneuil Watch Tool Co., Boston, Mass.

Clocks, Watchman's
Nanz & Co., New York.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Coil Clutch Mfg. Co., New York.
Eastern Mchry Co., New Haven, Conn.
Faneuil Watch Tool Co., Boston, Mass.
Jacobson Mach. Mfg. Co., Warren, Pa.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Christensen, N. A., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Gray-Blaisdell Co., Bradford, Pa.
Ingersoll-Sergeant Drill Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Knell Air Brake Mfg. Co., Battle Creek, Mich.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury Conn.

Coping Machines
Long & Allstatter Co., Hamilton Ohio.

Correspondence Schools
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Cost Keeping System
Derby Desk Co., New York.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Smith Single Belt Reversing Countershaft Co., Melrose, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.

Coupler, Hose
Clark Co., W. J., Salem, O.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.
Vandegrift Coupling Co., Evansville, Ind.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Cutting-off Machines
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Diamond Tools
Dickinson, Thos. L., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Perkins Mach. Co., So. Boston, Mass.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Dowel Pins
Winkley Co., Hartford, Conn.

Drawing Boards and Tables
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Alteneder & Son, Theo., Phila., Pa.
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Aurora Tool Wks., Aurora, Ind.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester, Mass.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, O.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cincin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mueller Mach. Tool Co., Cincin., O.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reade Mchry. Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.

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Marshall & Huschart Mchry. Co., Chicago, Ill.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.
Washburn Shops, Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas. Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Co., Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. Co., Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
General Elec. Co., New York.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Cooper Mach. Co., Saltsburg, Pa.
Elyria Engine Co., Elyria, O.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
National Engine Co., Rockford, Ill.
New England Gas Engine Co., Boston, Mass.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Works, Freeport, Ill.
Struthers-Wells Co., Warren, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill
Westinghouse Elec. & Mfg. Co. Pittsburgh, Pa.

Files, Letter
Derby Desk Co., New York.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.
Troy File Works, Troy, N. Y.

Filing Machines
Cochrane-Bly Mach. Co., Rochester, N. Y.

Fillers, Oil Can
Burt Mfg. Co., Akron, O.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.

Forges
Buffalo Forge Co., Buffalo, N. Y.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.
Jacobson Mach. Mfg. Co., Warren, Pa.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Furnaces
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
Knell Air Brake Mfg. Co., Battle Creek, Mich.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Works, Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. Y.
Lubriphite Co., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Falkenau-Sinclair Co., Phila., Pa.
Frasse Co., New York.
Goodell-Pratt Co., Greenfield, Mass.

Grinding Machines—*Continued*
Gorton Mach. Co., Geo., Racine, Wis.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Prov., R. I.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co. Chicago, Ill.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Ohio.
Vitrified Wheel Co., Westfield, Mass.
Tanite Co., Stroudsburg, Pa.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Tanite Co., Stroudsburg, Pa.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Lombard & Co., Boston, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Frasse Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Iroquois Machine Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Hammers, Power
Scranton & Co., The, New Haven, Conn.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Eastern Mchry. Co., New Haven, Conn.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
Sprague Electric Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Knell Air Brake Mfg. Co., Battle Creek, Mich.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Index, Cards
Derby Desk Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Key Seaters
Baker Bros., Toledo O.
Bement, Miles & Co., New York.
Chattanooga Mchry Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Keys, Machine
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathes
American Tool Wks. Co., Cin., O.
Auto. Mach. Co., Bridgeport, Ct.
Automatic Mach. Co., Greenfield, Mass.
Barker & Co., Wm., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Prov., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Frasse Co., New York.
Garvin Mach. Co., New York.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry Co., Chicago, Ill.

Lathes—*Continued*
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Tanite Co., Stroudsburg, Pa.
Mich.
Washburn Shops, Worcester, Mass.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Wood
American Machinery Co., Grand Rapids, Mich.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.
Narragansett Mach. Co., Providence, R. I.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.
Lubriphite Co., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lubriphite Co., Jersey City, N. J.
Lunkenheimer Co., Cincinnati, O.

Lumber, Patternmakers'
Johnson Lumber Co., Milwaukee, Wis.

Machinery Builders, Special
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Fdry. & Mach. Co., Hanover, Pa.
Atlas Foundry & Mch. Co., Belleville, N. J.
Blanchard Mach. Co., The, Boston, Mass.
Fawcus Mch. Co., Pittsburgh, Pa.
Knell Air Brake Mfg. Co., Battle Creek, Mich.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.

Machine Screws
Atlantic Mach. Screw Co., Boston, Mass.
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Lowe, H. A., Waltham, Mass.
McCrosky & Huber, Cincinnati, O.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mch. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., New Haven, Conn.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
American Foundry & Mach. Co., Hanover, Pa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Christensen Engr. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N.J.
Eck Dynamo & Motor Wks., Belleville, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Mechanical Appliance Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Nail Machinery, Wire
National Machy. Co., Tiffin, O.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
G. & P. Engraving Co., Boston, Mass.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Oil Cups and Covers
Bay State Stamping Works, Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
Lyon Metallic Mfg. Co., Chicago, Ill.
New Britain Mch. Co., New Britain, Conn.

Pans, Shop
Lyon Metallic Mfg. Co., Chicago, Ill.

Patents
Frothingham, N. L., New York.
Baldwin, Davidson & Wight, Washington, D. C.
Straley, Hasbrouck & Schloeder, New York.

Patternmakers' Lumber
Johnson Lumber Co., Milwaukee, Wis.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Greaves, Klusman & Co., Cin., O.
Prentiss Tool & Supply Co., New York.
Washburn Shops, Worcester, Mass.

Patterns, Wood
Gobeille Pattern Co., Cleveland, O.

Pencils
Keuffel & Esser Co., New York.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
American Tool Wks. Co., Cin., O.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Bench
Bartlett, E. E., Boston, Mass.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Presses, Hand
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Perkins Mach. Co., So. Boston, Mass.

Presses, Hydraulic
Elmes Engr. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Co., T. C., Phila., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Perkins Mach. Co., Boston, Mass.
Prentiss Tool & Supply Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
American Tool Wks. Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.
Saunders Mfg. Co., Dayton, O.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pulleys, Speed Changing
Speed Changing Pulley Co., Indianapolis, Ind.

Pumps, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Chadwick & Co., G. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q & C Co., Chicago, Ill.
Standard Ry. Equip. Co., St. Louis, Mo.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engr. Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.
Perkins Mach. Co., So. Boston, Mass.

Rods and Straps, Connecting
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
American Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Co., T. C., Phila., Pa.
Hilles & Jones Co., Wilmington, Del.
Iroquois Mach. Co., Providence, R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Rules, Steel
Sawyer Tool Co., Fitchburg, Mass.
Starrett Co., L. S., Athol, Mass.

Safety Valves, Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Cochrane-Bly Mach. Works, Rochester, N. Y.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Sawing Machines, Wood
American Machinery Co., Grand Rapids, Mich.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.
Railway Educational Association, Brooklyn, N. Y.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Affleck, Geo. E., New York.
Baird Machy. Co., Pittsburg, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegheny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wickes Bros., New York.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Separators, Oil
Springfield Separator Co., Manchester, N. H.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shapers
American Tool Wks. Co., Cin., O.
Barker & Co., Wm., Cincinnati, O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mch. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Perkins Mach. Co., Boston, Mass.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
National Mchry. Co., Tiffin, O.
Perkins Mach. Co., Boston, Mass.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Reade Mchry Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Perkins Mach. Co., So. Boston, Mass.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett, E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Wks., Wilmington, Del.
Dill Mach. Co., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Spike Machines
National Machy. Co., Tiffin, O.

Sprocket Chains
See Driving Chains.

Stampings, Sheet Steel
Federal Mfg. Co., Cleveland, O.

Stamps, Steel
The Chandler Co., Springfield, Mass.
Schwerdtle Stamp Co., Bridgeport, Conn.

Steel, Machinery
Boker & Co., Hermann, New York.
Patriache & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
Boker & Co., Hermann, New York.
Patriarche & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Rement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., New Haven, Conn.
National Mchry. Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps, Collapsing
Geometric Drill Co., New Haven, Conn.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Geometric Drill Co., New Haven, Conn.
Hammacher, Schlemmer & Co., New York.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Mchry. Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Winter Bros. Co., Wrentham, Mass.

Telephone System
Clark Auto. Telephone Switch Board Co., Providence, R. I.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.
Saunders Mfg. Co., Dayton, O.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Washburn Shops, Worcester, Mass.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Graham Mfg. Co., Provi., R. I.
Hollands Mfg. Co., Erie, Pa.
Jacobson Mach. Mfg. Co., Warren, Pa.

Vises, Metal Workers'
Hammacher, Schlemmer & Co., New York.
Jacobson Mach. Mfg. Co., Warren, Pa.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Washer Machines
National Machy. Co., Tiffin, O.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Drawing Machinery
Iroquois Mach. Co., Provi., R. I.
Mossberg & Granville Mfg. Co., Providence, R. I.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.

Wood Working Machinery
American Machinery Co., Grand Rapids, Mich.

Worm Hobbing Machines
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Automatic Mach. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.